УНИВЕРЗИТЕТ ЦРНЕ ГОРЕ
МЕТАЛУРШКО-ТЕХНОЛОШКИ ФАКУЛТЕТ

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Подгорица, 10.09.2021

UNIVERZITET CRNE GORE

CENTAR ZA DOKTORSKE STUDIJE
-N/R Prof. dr Predrag Miranović, rukovodilac Centra

Podgorica

Poštovani,

U prilogu akta dostavljamo prijavu teme doktorske disertacije Uticaj prelaznih metala na strukturu i sorpcione osobine nanokompozita na bazi magnezijum hidrida", kandidatkinje MSc Zorane Sekulić, sa predlogom odluke o imenovanju Komisije za ocjenu podobnosti doktorske teze i kandidata i izvještajem Komisije za doktorske studije MTF, koji su razmotreni i usvojeni na sjednici Vijeća Metalurško-tehnološkog fakulteta od 10.09.2021. godine.

Srdačan pozdrav,

DEKAN,
Prof. dr Mira Vukčević

Crna Gora
UNIVERZITET CRNE GORE
METALURŠKO-TEHNOLOŠKI FAKULTET

Broj 1350
Podgorica, 10.09.21 god.

Na osnovu člana 64 Statuta Univerziteta Crne Gore Gore („Bilten UCG" br. 337/2015 i br. 447/2018) i inicijalnog predloga Komisije za doktorske studije Metalurško-tehnološkog fakulteta br. 1329 od 08.09.2021. godine, a u vezi sa članom 32 i čl. 34 Pravila doktorskih studija Univerziteta Crrne Gore i t. 3.5 Vodiča za doktorske studije Univerziteta Crne Gore, Vijeće Metalurško-tehnološkog fakulteta u Podgorici, na sjednici održanoj 10.09.2021. godine, donijelo je-

O D L U K U

I Prijava teme doktorske disertacije „Uticaj prelaznih metala na strukturu i sorpcione osobine nanokompozita na bazi magnezijum hidrida", kandidatkinje MSc Zorane Sekulić, ispunjava formalne uslove za prijavu teme.

II Imenuje se *Komisija za ocjenu podobnosti doktorske teze i kandidata* pod navedenim nazivom, u sastavu:

1. Prof. dr Vanja Asanović, redovni profesor, Podgorica, mentor,
2. Prof. dr Jasmina Grbović Novaković, naučni savjetnik, Institut za nuklearne nauke "Vinča", Beograd,
3. Prof. dr Nada Jauković, redovni profesor, MTF, Podgorica.

III Zadatak Komisije je da utvrdi da li predložena tema odgovara po svom sadržaju nivou doktorskih studija (poređenje sa ishodima), da li omogućava originalan naučno-istraživački rad koji odgovara međunarodnim kriterijumima kvaliteta disertacije i da li kandidat može, na osnovu sopstvenog akademskog kvaliteta i stečenog znanja, da uz adekvatno mentorsko vođenje realizuje postavljeni cilj i dokaže hipoteze.

IV Senat, na predlog Odbora za doktorske studije, imenuje Komisiju za ocjenu podobnosti doktorske teze i kandidata.

CO:
-Odbor za doktorske studije,
-Sekretar
-a/a.

DEKAN
Prof. dr Mira Vukčević

PRIJAVA TEME DOKTORSKE DISERTACIJE

OPŠTI PODACI O DOKTORANDU	
Titula, ime i prezime	MSc Zorana Sekulić
Fakultet	Metalurško-tehnološki fakultet
Studijski program	Metalurgija i materijali
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Obrazovanje	**PhD** student Metalurgija i materijali, Metalurško – tehnološki fakultet, Univerzitet Crne Gore, upisana 2019. godine **MSc** Hemijska tehnologija – Ekologija, Metalurško – tehnološki fakultet, Univerzitet Crne Gore, 2013. godine, srednja ocjena 10.00 **Spec.Sci** Hemijska tehnologija - Elektrohemijski Procesi i Proizvodi, Metalurško – tehnološki fakultet, Univerzitet Crne Gore, 2011. godine, srednja ocjena 8.63 **BSc** Hemijska Tehnologija, Metalurško – tehnološki fakultet, Univerzitet Crne Gore, 2009. godine, srednja ocjena 7
Radno iskustvo	06/2012 - do sada, Pivara „Trebjesa" DOO Nikšić, Crna Gora, Specijalista u Kontroli kvaliteta 09/2011-06/2012, Skupština Crne Gore, Podgorica, Crna Gora, Sekretar u poslaničkom klubu 07/2010-11/2010, EXPO 2010 SHANGHAI, Šangaj, Kina, Informator u crnogorskom paviljonu
Popis radova	Kandidatkinja do sada nije objavljivala naučne radove. Svoju profesionalnu karijeru poslednjih deset godina gradi u industrijskom sektoru u okviru kojeg je stekla dragocjeno praktično iskustvo u dijelu upravljanja i kontrole procesa i kvaliteta prozvoda, kreiranja proizvoda, primjeni i razradi savremenih tehnologija, procjeni rizika i itd.
NASLOV PREDLOŽENE TEME	
Na službenom jeziku	Uticaj prelaznih metala na strukturu i sorpcione osobine nanokompozita na bazi magnezijum hidrida
Na engleskom jeziku	Influence of transition metals on the structure and sorption properties of nanocomposites based on magnesium hydride

Obrazloženje teme

Koncept vodonične ekonomije pruža mogućnost za dekarbonizaciju energetskog sektora i obezbjeđenje pouzdanog, bezbjednog i održivog snabdijevanja čistom energijom. Iako su razvijena neka tehnološka rješenja za back-up napajanja mobilnih telefona i kompjuterskih sistema, kao i pokretanje automobila, aktuelan je izazov organizovanja održive proizvodnje, transporta i skladištenja vodonika [1, 2]. Jedan od zadataka koji treba riješiti kako bi se vodonična energetika primijenila u značajnoj mjeri je uspostavljanje sigurnog, kompaktnog, energetski efikasnog i ekonomičnog sistema za skladištenje vodonika posebno u slučaju upotrebe u prevoznim sredstvima [1]. Magnezijum hidrid je prepoznat kao potencijalni materijal u tom smislu zbog visokog kapaciteta vodonika, dobre reverzibilnosti i niske cijene, ali njegovu praktičnu primjenu ograničava velika termodinamička stabilnost i spora kinetika sorpcije [3]. U sklopu disertacije sprovešće se mehanohemijsko modifikovanje strukture magnezijum hidrida dopiranjem prelaznim metalima, strukturna i morfološka karakterizacija modifikovanih kompozita, ispitivanje nastalih novih faza, kinetička i termodinamička ispitivanja sorpcije vodonika sa nanokompozita, kako bi se dizajnirala mikrostruktura neophodna za poboljšanje kinetike sorpcije i osobina za skladištenje vodonika.

Pregled istraživanja

Upotreba vodonika, kao alternativnog goriva, predstavlja dobar izbor s obzirom na rasprostranjenost u prirodi i sagorijevanje koje nije praćeno zagađenjem životne sredine. Vodonik kao energetski vektor budućnosti može se proizvesti iz bilo kog primarnog energenta (ugalj, nafta, nuklearna energija, prirodni gas), svih vrsta obnovljivih izvora energije, kao i iz električne mreže. Toplota sagorijevanja vodonika je tri puta veća nego benzina (143 MJ/kg) [3], ali su proizvodnja, skladištenje i transport ipak izazovi na putu praktične primjene vodonika kao energetskog vektora. U vodoničnoj ekonomiji, među pomenutim izazovima, najveće tehničko usko grlo predstavlja skladištenje vodonika [4]. Svjetska naučna zajednica je usmjerena na pronalaženje materijala za čuvanje vodonika na bezbjedan, ekonomski prihvatljiv i efikasan način. Trenutni načini skladištenja koji obuhvataju komprimovanje vodonika pod pritiskom do 700 bara predstavljaju ozbiljan bezbjednosni rizik, dok velike troškove izaziva čuvanje u tečnom stanju na kriogenim temperaturama (vodonik ključa na - 253 °C) [5]. U tom smislu skladištenje u čvrstom stanju, upotrebom prvenstveno metalnih hidrida, predstavlja ozbiljnu alternativu jer nudi bezbjednost manipulacije bilo u stacionarnoj ili mobilnoj primjeni, kao i veći gravimetrijski kapacitet vodonika. Među različitim materijalima za skladištenje vodonika u čvrstom stanju magnezijum hidrid (MgH_2) se izdvaja kao naročito atraktivan obzirom na reverzibilnost metal-hidrid-metal sistema MgH_2-Mg, visoki kapacitet vodonika, i veliku energije Mg-H veze [6]. U metalnim hidridima, praškasti metal apsorbuje vodonik pod visokim pritiskom, a tokom ovog procesa se stvara toplota. Najveći problem ove metode je masa materijala koji vrši apsorpciju vodonika, odnosno masa tanka koja bi iznosila oko 600 kg. Masa tanka za čuvanje komprimovanog gasa H_2 je 80 kg [5]. Skladištenje vodonika adsorpcijom u ugljeničnim materijalima i metalno organskim okvirima (MOF) predstavlja novu oblast u istraživanju materijala, adekvatnu sa aspekta većeg kapaciteta uskladištenog vodonika [7].

U poređenju sa skladištenjem vodonika u gasovitom i tečnom stanju, skladištenje vodonika u čvrstom stanju predstavlja obećavajuću alternativu upravo zbog nižeg radnog pritiska, manipulativne temperature i parametara pritiska. Materijali koji se proučavaju kao kandidati za čuvanje vodonika u čvrstom stanju su metalni hidridi (Mg-H, Pd-H, V-H), kompleksni hidridi (uglavnom na bazi Mg, Al ili Li), legure (čvrsti rastvori sa prost-c-k rešetkom kao u sistemu Ti-Cr-V, intermetalna jedinjenja tipa AB, A_2B, AB_2, AB_5 kao što su TiFe, Mg_2Ni, ZrV_2 i $LaNi_5$) i adsorbenti –fizisorpcija (na bazi ugljenika ili metalno organski okviri poroznih struktura) [1-2, 8]. Širok opseg parametara performansi (radna temperatura, sorpciona kinetika, uslovi aktivacije,

ciklusne opcije i ravnotežni pritisak vodonika) koji karakteriše pomenute materijale mogu se poboljšati ili prilagoditi kako bi se ispunili tehnički zahtjevi za različite primjene [9].

Među materijalima za skadištenje vodonika u čvrstom stanju, jako dobro su ispitani materijali na bazi magnezijuma, upravo zbog visokog kapaciteta vodonika (7.6 mas % za MgH_2), obilne zastupljenosti magnezijuma u zemljinoj kori (2.3 %), i niske cijene metala magnezijuma (2-3 USD kg_{Mg}^{-1})[9]. Sa druge strane, hemijska veza vodonika i metala u ovim jedinjenjima je obično jaka, što posledično dovodi do spore kinetike i visoke temperature dehidriranja. Procesima destabilizacije strukture (upotreba visoko-energetskih mlinova, aditiva, jonsko bombardovanje itd.) mogu se unaprijediti ili kontrolisati nedostaci ovih materijala, i kao takvi upotrijebiti za efikasno skladištenje vodonične energije. Međutim, i pored brojnih istraživanja u ciju poboljšanja kinetike ovog materijala, još uvijek nije uspješno pronađeno adekvatno rješenje koje bi destabilizacijom strukture učinilo ovaj materijal prihvatljivim za aplikaciju u pomenute svrhe. Ova doktorska disertacija će predstavljati doprinos istraživanju uticaja dopiranja prelaznim metalima i metoda pripreme uzorka na destabilizaciju kristalne rešetke magnezijum hidrida, odnosno sniženje temperature desorpcije i ubrzanje kinetike, kako bi ovaj materijal bio efikasan nosač vodonične energije.

Liang i saradnici [10] su ispitivali uticaj prelaznih metala (3d prelazni metali: Ti, V, Mn, Fe i Ni) kao aditiva na sorpcione osobine MgH_2, pri čemu su praškasti nanokompoziti sintetisani mljevenjem u periodu od 20 h. Desorpcija je bila najbrža kod sistema MgH_2-V, zatim kod MgH_2-Ti, MgH_2-Fe, MgH_2-Ni i MgH_2-Mn na nižim temperaturama. Sa druge strane, Mg-Ti pokazuje najbržu apsorpcionu kinetiku, zatim Mg-V, Mg-Fe, Mg-Mn i na kraju Mg-Ni. Od ispitivanih prelaznih metala V i Ti su pokazali bolji katalitički efekat od Ni pri apsorpciji i desorpciji vodonika. Kompoziti sa V ili Ti kao aditivom pokazuju vrlo brzu desorpcionu kinetiku iznad 250 °C i apsorpcionu kinetiku na temperaturama nižim od 30 °C. Aktivaciona energija desorpcije vodonika se drastično smanjuje u slučaju 3d metala kao aditiva, pri čemu ne dolazi do promjene termodinamičkih osobina MgH_2.

Sun i saradnici [3] su ispitivali uticaj prelaznih metala u kombinaciji sa ugljeničnim materijalima na osobine skladištenja vodonika u MgH_2. Dopiranje prelaznim metalima i njihovim legurama se uošteno smatra najjednostavnijom metodom za ubrzanje sorpcione kinetike MgH_2. Desorpcione osobine ispitivanih sistema se mogu rangirati na sljedeći način: Mg-Ti > Mg-Nb > Mg-Ni > Mg-V > Mg-Co > Mg-Mo. Svi navedeni kompoziti mogu otpuštati vodonik na temperaturama ispod 225°C, što je mnogo niže nego za čisti MgH_2.

Liang i saradnici [11] su ispitivali desorpcione osobine kompozita MgH_2+V pripremljenog kugličnim mljevenjem. Kompozit MgH_2+5 at% V može desorbovati vodonik na 200°C i reapsorbovati vodonik brže čak i na sobnim temperaturama. Aktivaciona energija desorpcije vodonika je smanjena na 62 kJ mol^{-1}.

Gasan i saradnici [12] su ispitivali uticaj 5 mas % aditiva (V, Nb i Ti) na temperaturu desorpcije vodonika u MgH_2. Rezultati rendgenske difrakcije praha (XRD) su pokazali da dodatak praha vanadijuma ima značajan uticaj na transformaciju Mg u MgO ili hidride, jer je količina MgO u sistemu MgH_2-V bila veća nego u drugim sistemima. Ispitivanje skenirajućom elektronskom mikroskopijom pokazalo je takođe, značajno smanjenje veličine čestice praha na mikro nivou. Rezultati dobijeni diferencijalnom skenirajućom kalorimetrijom pokazali su da dodatak 5 % aditiva utiče na sniženje temperature desorpcije vodonika u MgH_2 za oko 40 °C – 50 °C.

Lu i saradnici [13] su ispitivali katalitički efekat dvodimenzionalnih (2D) vanadijumskih nanoploča (V_{NS}) na MgH_2 za potrebe skladištenja vodonika. Zbog visoke termalne stabilnosti, spore apsorpcione i desorpcione kinetike pri praktičnoj primjeni Mg/MgH_2 sistema, Lu i saradnici su vrlo uspješno dopirali ovaj sistem 2D vanadijumskim nanopločama sintetisanim postupkom vlažnog mljevenja u trajanju od 45 sati, što se pokazalo izuzetno efikasnim sa

aspekta poboljšanja performansi skladištenja vodonika u MgH_2. Utvrđeno je da kompozit MgH_2 + 7 mas % V_{NS} počinje da otpušta vodonik na 187.2 °C, odnosno na temperaturi za 152 °C nižoj od MgH_2 bez aditiva. U toku 10 minuta na 300 °C, otpušteno je 6.3 mas % vodonika iz MgH_2 + 7 mas % V_{NS} kompozita. Dodatno, u potpunosti dehidriran uzorak može apsorbovati vodonik čak i na sobnoj temperaturi, pod pritiskom vodonika od 3.2 MPa.

Hanada i saradnici [14] su ispitivali katalitički efekat nanočestica 3d-prelaznih metala na desorpciju vodonika kod MgH_2 pripremljenog metodom kugličnog mljevenja. Svi MgH_2 kompoziti pripremljeni dodavanjem male količine nanočestica Fe^{nano}, Co^{nano}, Ni^{nano} i Cu^{nano} metala i kugličnim mljevenjem u periodu od 2 sata, pokazuju mnogo bolju desorpciju vodonika nego čist MgH_2. Najbolje osobine su primijećene za kompozit na bazi MgH_2 koji je dopiran nanočesticama 2 mol % Ni^{nano} i pripremljen kratkotrajnim (15 min) kugličnim mljevenjem manjeg intenziteta (200 rpm). Utvrđeno je da je velika količina vodonika (~6.5 mas %) desorbovana u temperaturnom opsegu od 150 °C do 250 °C bri zagrijavanju brzinom od 5 °C/min pod protokom gasa He, praktično bez parcijalnog pritiska vodonika.

Predmet polaznih istraživanja predstavlja ispitivanje uticaja vanadijuma na poboljšanje kinetičkih performansi magnezijum hidrida. Vanadijum je izabran kao 3d prelazni metal koji pokazuje katalitički efekat na svojstva desorpcije vodonika. Istraživan je uticaj dopiranja vanadijumom (u količini od 2 mas % V i 5 mas % V) i metode mehaničkog mljevenja u visokoenergetskom kugličnom mlinu (High Energy Ball Milling, HBM), pri različitim vremenima mljevenja (15 min, 30 min i 45 min) na destabilizaciju strukture magnezijum hidrida i dobijanje nanokompozita. Sprovedena je mikrostrukturna i morfološka karakterizacija dobijenih materijala. Praćen je i uticaj na temperaturu dehidriranja i kinetiku desorpcije vodonika. Nastavak istraživanja će se usmjeriti i na mehanohemijsku sintezu nanomaterijala uz dopiranje 4d i 5d prelaznim metalima kako bi se uporedili njihovi efekti na sorpciju vodonika.

Cilj i hipoteze

Poslednjih decenija svjedočimo sve brojnijim naporima u prevazilaženju problema koji generiše upotreba fosilnih goriva, pri čemu najveći doprinos u ovom momentu daje naučna zajednica. Sa druge strane podrška i obavezujuće smjernice pruža Evropska unija, koja je u julu 2020. godine usvojila Strategiju za vodonik za klimatski neutralnu Evropu [15]. Evropskim zelenim planom je predviđen set mjera za smanjenje emisije gasova sa efektom staklene bašte na 55 % do 2030. godine u poređenju sa nivoom emisije iz 1990. godine, kreiranje zelenih radnih mjesta i u krajnjem postizanje klimatske neutralnosti Evropske unije do 2050. godine [16]. U skladu sa tim, opšti cilj ove doktorske disertacije je razvoj tehnologije za dobijanje nanokompozita odnosno novih materijala sa poboljšanim osobinama za skladištenje vodonika. Planirano istraživanje obuhvatiće definisanje optimalnih uslova za mehanohemijsku destabilizaciju strukture magnezijum hidrida koji će se dopirati prelaznim metalima, proučavanje faznih transformacija, analiziranje raspodjele veličina čestica, utvrđivanje kinetičkog modela za opisivanje kinetike desorpcije vodonika iz nanokompozita, kao i utvrđivanje korelacije sastav-struktura-karakteristike.

Hipoteza: Kombinovanjem nanostrukturiranja putem kratkotrajnog mehaničkog mljevenja magnezijum hidrida i katalitičkog djelovanja prelaznih metala kao dopanata moguće je dizajnirati nove materijale (nanokompozite) poboljšanih sorpcionih osobina.

Materijali, metode i plan istraživanja

Iako su Toyota, Honda, Hyundai i Mercedes lansirali proizvodnju nekih modela automobila uvodeći pogon na vodonične gorivne ćelije, njihova široka primjena je ipak limitirana visokom cijenom rezervoara i sigurnosnim problemima, pri čemu nije dostignut ni kriterijum 6.5 mas % za minimalni kapacitet materijala za skladištenje vodonika koji je postavilo Ministarstvo

energetike Sjedinjenih Američkih Država (DOE) [17]. Stoga je razvoj novih sistema koji će omogućiti efikasno, bezbjedno i ekonomski prihvatljivo skladištenje vodonika i dalje imperativan za uvođenje zelene vodonične infrastrukture.

Doktorska disertacija ima za cilj sintetisanje nanokompozitnih materijala na bazi magnezijum hidrida dopiranog prelaznim metalima inovativnim metodama, pri čemu bi se pratile fazne transformacije i uticaj na sorpcionu kinetiku vodonika u ispitivanim materijalima. Magnezijum hidrid je odabran kao osnovni materijal za ispitivanje sa aspekta visokog kapaciteta vodonika, rasprostranjenosti, cjenovne konkurentnosti i netoksičnosti. Glavni nedostatak praktične primjene sistema Mg/MgH_2 je visoka termalna stabilnost i spora sorpciona kinetika [13].
Dizajniranje novih materijala za skladištenje vodonika u okviru ove disertacije se bazira na sinergijskom efektu mehaničkog mljevenja i katalitičkog djelovanja dopanata. Istraživanja uticaja dopiranja magnezijum hidrida prelaznim metalima ukazuju na mogućnost poboljšanja apsorpcione kinetike i smanjenje aktivacione energije desorpcije vodonika [3, 10-14], tako da će se u ovoj disertaciji proučavati katalitičko djelovanje 3d metala, 4d metala i 5d metala.
Destabilizacija strukture magnezijum hidrida pomiješanog sa prelaznim metalima kao dopantima sprovešće se mehaničkim mljevenjem. Visoko energetsko kuglično mljevenje je izabrano kao metoda sinteze zbog postizanja fine, uniformne disperzije čestica koja se ne može dobiti konvencionalnim metodama. Osim toga, mehanohemija je zelena metoda sinteze, s obzirom da se ne koriste rastvarači. Materijali na bazi magnezijuma poboljšanih osobina, mogu se dobiti dugotrajnim mljeveljem prahova u kugličnim mlinovima, koje intenzivira ulogu granica zrna u procesu i ubrzava difuziju vodonika [18]. Upotreba visoko energetsko kugličnog mljevenja je vrlo efikasna za pripremu materijala na bazi nanostrukturiranih magnezijum hidrida namijenjenih skladištenju vodonika [19]. Poznata je kao novija tehnika sinteze za pripremu materijala nanometarske veličine i neravnotežnog stanja. Kuglično mljevenje, u skladu sa različitim funkcijama, može biti klasifikovano u tri kategorije: mehaničko mljevenje, mehaničko legiranje i reaktivno kuglično mljevenje, iako granice nisu strogo definisane [20].
U sklopu eksperimentalnih polaznih istraživanja analiziran je uticaj jednog prelaznog metala – vanadijuma, kojim je dopiran magnezijum hidrid. Nanokompoziti $MgH_2 - 5$ % V i $MgH_2 - 2$ % V su sintetisani u visokoenergetskom mlinu. Prah magnezijum hidrida (komercijalni prah) sa dodatkom razaličitih masenih udela vanadijuma (2 mas % i 5 mas %) sintetisan je u posudi od nerđajućeg čelika u mlinu SPEX Sample Prep Mixer/Mill 5100. Upotrijebljena je kuglica prečnika 6 mm, izrađena takođe od nerđajućeg čelika. Magnezijum hidrid sa dodatkom vanadijuma u različitim masenim procentima mljeven je pri različitim vremenskim intervalima (15 min, 30 min i 45 min) u inertnoj atmosferi argona kako bi se spriječila oksidacija uzorka. Odnos mase kuglica i mase praha upotrijebljenog materijala BPR (Ball to Powder Ratio) iznosio je $\approx$ 10:1. Tokom samog procesa sinteze, modifikovana je struktura magnezijum hidrida dopiranog vanadijumom. Karakterizacija kristalne strukture je izvršena pomoću rendgenske strukturne analize (XRD), a mikrostrukturna karakterizacija skenirajućom elektronskom mikroskopijom SEM (morfološka i hemijska analiza). Utvrđivanje raspodjele čestica na osnovu njihove veličine je realizovano laserskom difrakcijom za analizu veličine čestica (PSD). Diferencijalna skenirajuća kalorimetrija (DSC) je primijenjena za kinetička i termodinamička ispitivanja dobijenih materijala, dok je temperaturno programirana desorpcija (TPD) pružila podakte o termičkim osobinama materijala.

Istraživanje u okiru disertacije obuhvata četiri faze. U prvoj fazi istraživanja sprovedena je detaljna analiza naučnih radova u cilju sagledavanja postojećih rezultata proučavanja materijala na bazi magnezijuma za skladištenje vodonika, kao i otvorenih pitanja, odnosno problema koje treba rješavati. Planirani eksperimenti za polazna istraživanja su realizovani u laboratorijama

Instituta za nuklearne nauke „Vinča" – Centra izuzetnih vrednosti za vodoničnu energetiku i obnovljive izvore energije – CONVINCE (Republika Srbija) i u laboratorijama Instituta za tehničke nauke SANU (Srpska akademija nauka i umetnosti).
U drugoj fazi istraživanja planirana je sinteza novih nanokompozita, pri čemu bi se MgH_2 kao osnovni materijal dopirao odabranim 3d, 4d i 5d metalima. Brojna istraživanja pokazuju pozitivan uticaj prelaznih metala i njihovih jedinjenja na kinetiku sorpcije vodonika u MgH_2. Zabilježeno je znatno lakše otpuštanje i prihvatanje vodonika, pri nižim teperaturama, redukcija aktivacione energije desorpcije kao i visok reverzibilni kapacitet vodonika [3, 10-14, 21-24]. Formiranje novih i metastabilnih faza, interakcije nove faze i nanokristalnih površina, defekti u rešetki, praznine, fazne transformacije i granice zrna mogu značajno da utiču na reverzibilnost skladištenja vodonika [25]. Stoga, u cilju sagledavanja korelacije struktura-osobine, nakon sinteze nanokompozita slijedila bi treća faza istraživanja posvećena detaljnoj karakterizaciji. Prvo bi se sprovela morfološka i mikrostruturna karakterizacija metodama mirkostrukturne analize (XRD), laserske metode za određivanje raspodjele veličine čestica (PSD) i skenirajuće elektronske mikroskopije (SEM). Nakon toga, temperaturno programiranom desorpcijom (TPD) ispratio bi se proces dehidriranja vodonika u ispitivanom materijalu. Proces desorpcije će se u četvrtoj fazi istraživanja opisati izabranim kinetičkim modelom.

Metoda difrakcije X-zraka je efikasna analitička tehnika koja će se koristi za karakterizaciju nanostukturiranog materijala proizvedenog kugličnim mljevenjem [26]. Analizom će se dobiti difraktogrami na kojima položaj maksimuma definiše prisustvo određene faze (na primjer: β ili γ-MgH_2). Skenirajućom elektronskom mikroskopijom (SEM), kao mikroskopskom metodom visoke rezolucije izvršiće se vrlo precizna karakterizacija fine površine uzorka. Metodom za određivanje raspodjele veličine praha (PSD ili PSA), koja se zasniva na principu laserske difrakcije svjetlosti, utvrdiće se uticaj vremenskog trajanja mljevenja na raspodjelu veličine čestica. Manje čestice rasipaju svjetlost manjeg inteziteta ali pod većim uglom, a rasijanje svjetlosti jačeg inteziteta, pod oštrijim uglom se javlja za krupnije čestice.
Diferencijalna skenirajuća kalorimetrija (DSC) je termoanalitička metoda kojom se potrebne informacije o termijskim promjenama u materijalu dobijaju zagrijavanjem ili hlađenjem uzorka zajedno sa inertnim referentnim uzorkom. Mjerenje se može izvesti na konstantnoj temperaturi (izotermički) ili promjenom temperature konstantnom brzinom [27]. Na taj način dobijamo kvalitativne i kvantitativne podatke o osobinama materijala kao što su: entalpija topljenja i kristalizacije, tačka topljenja, specifična i latentna toplota, toplotna provodljivost, specifični toplotni kapacitet kao i podatke o termičkoj stabilnosti [28].
Temperaturno programiranom desorpcijom (TPD) dolazi do zagrijavanja uzorka od sobne do zadate temperature, pri čemu se desorpcijom gasova iz uzorka prati disocijacija, površinske i promjene po dubini uzorka. Prilikom desorpcije gasa dolazi do izdvajanja gasa koji se detektuje na masenom analizatoru koji je uparen sa TPD-om. Dobija se grafik zavisnosti parcijalnog pritiska od temperature površina ispod pika, koji predstavlja količinu desorbovanog gasa dok se iz položaja pika može odrediti entalpija desorpcije [29].
Nakon kompletne strukturne i termalne karakterizacije, planirano je razvijanje metodologije za pouzdano predviđanje procesa razlaganja nanokompozita, odnosno desorpcije sa objedinjenim setom parametara kinetičkog modela. Predviđanje toplotnog odgovora ispitivanog materijala zahtijeva tačne ulazne parametre izvedene iz pouzdane karakterizacije termalnih osobina i kinetičkih modela. Svojstva kompozitnog materijala zavise u mnogome od temperature i brzine zagrijavanja. Obično, konvencionalni kinetički modeli dobijeni objedinjavanjem podataka termogravimetrijske analize rezultuju sa više skupova parametara kinetičkih modela, koje je teško numerički interpretirati [30].

Očekivani naučni doprinos

Istraživanje usmjereno na dobijanje novih materijala za skladištenje vodonika u čvrstom stanju prvi put se organizuje u Crnoj Gori u saradnji sa naučnicima iz Instituta za nuklearne nauke „Vinča" – Centra izuzetnih vrednosti za vodoničnu energetiku i obnovljive izvore energije – CONVINCE (Republika Srbija). Iako se strateškim dokumentima podstiče proizvodnja energije iz obnovljivih izvora i zaustavljanje klimatskih promjena, naučna i tehnička zajednica i dalje traži rješenje koje će omogućiti uvođenje zelene vodonične infrastrukture. Naučni doprinos istraživanja u okviru ove doktorske disertacije predstavlja razvoj tehnologije za dizajniranje nanokompozita poboljšanih osobina koji bi bili potencijalni nosači, odnosno služili za transport vodonika i samim tim omogućili njegovu bezbjednu i efikasnu primjenu, uz prihvatljive troškove. Definisaće se mehanohemijski protokoli za destabilizaciju strukture magnezijum hidrida uz dopiranje prelaznim metalima iz grupe 3d, 4d i 5d. Proučavanje faznih transformacija i detaljna karakterizacija osobina proizvedenih nanokompozita omogućiće utvrđivanje i razumijevanje korelacije osobina, hemijskog sastava, strukture i procesiranja novih materijala. Objavljivanje naučnih radova u časopisima sa SCI/SCIE liste i na međunarodnim konferencijama pokazaće doprinos crnogorskih naučnika istraživanjima u oblasti vodonične energetike.

Spisak objavljenih radova kandidata

Kandidatkinja nema do sada objavljenih naučnih radova. Objavljivanje prvog rada se očekuje u najskorijem periodu, upravo na bazi odrađenih polaznih istraživanja, zajedno sa saradnicima koji su učestvovali u izvođenju ovog ispitivanja.

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SAGLASNOST PREDLOŽENOG/IH MENTORA I DOKTORANDA SA PRIJAVOM		
Odgovorno potvrđujem da sam saglasan sa temom koja se prijavljuje.		
Prvi mentor	Prof. dr Vanja Asanović	
Drugi mentor		
Doktorand	MSc Zorana Sekulić	

IZJAVA

Odgovorno izjavljujem da doktorsku disertaciju sa istom temom nisam prijavio/la ni na jednom drugom fakultetu.

U Podgorici,
07.09.2021.

Ime i prezime doktoranda

UCG
Univerzitet Crne Gore

UNIVERZITET CRNE GORE
METALURŠKO-TEHNOLOŠKI FAKULTET
METALURGIJA I MATERIJALI
Broj dosijea: **1/2019**

Na osnovu člana 165 stava 1 Zakona o opštem upravnom postupku ("Službeni list RCG", broj 60/03.), člana 115 stava 2 Zakona o visokom obrazovanju ("Službeni list CG", broj 44/14.) i službene evidencije, a po zahtjevu studenta Sekulić Milan Zorana, izdaje se

UVJERENJE O POLOŽENIM ISPITIMA

Student **Sekulić Milan Zorana**, rođena **25-12-1986** godine u mjestu **Podgorica**, opština **Podgorica**, Republika **Crna Gora**, upisana je studijske **2019/2020** godine, u **I** godinu studija, kao student koji se **samofinansira** na **doktorske akademske studije**, studijski program **METALURGIJA I MATERIJALI**, koji realizuje **METALURŠKO-TEHNOLOŠKI FAKULTET** - Podgorica Univerziteta Crne Gore u trajanju od **3 (tri)** godine sa obimom **180** ECTS kredita.

Student je položio ispite iz sljedećih predmeta:

Redni broj	Semestar	Naziv predmeta	Ocjena	Uspjeh	Broj ECTS kredita
1.	1	FENOMENI SINTEROVANJA	"A"	(odličan)	7.00
2.	1	KINETIKA - VIŠI KURS	"A"	(odličan)	8.00
3.	1	MEHANIZMI OJAČAVANJA I DIZAJN MATERIJALA	"A"	(odličan)	7.00
4.	1	TERMODINAMIKA - VIŠI KURS	"B"	(vrlodobar)	8.00
5.	2	FAZNE TRANSFORMACIJE (ODABRANA POGLAVLJA)	"A"	(odličan)	7.00

Zaključno sa rednim brojem **5.**

Ostvareni uspjeh u toku dosadašnjih studija je:
- srednja ocjena položenih ispita **"A" (9.78)**
- ukupan broj osvojenih ECTS kredita **37.00** ili **61.67%**
- indeks uspjeha **6.03**.

Uvjerenje se izdaje na osnovu službene evidencije, a u svrhu ostvarivanja prava na: (dječji dodatak, porodičnu penziju, invalidski dodatak, zdravstvenu legitimaciju, povlašćenu vožnju za gradski saobraćaj, studentski dom, studentski kredit, stipendiju, regulisanje vojne obaveze i slično).

Broj:
Podgorica, 07.09.2021 godine

M. P.

Za SEKRETAR,

METALURŠKO- TEHNOLOŠKI FAKULTET

Crna Gora
UNIVERZITET CRNE GORE
METALURŠKO-TEHNOLOŠKI FAKULTET
Broj 1328
Podgorica, 08.09. 20 21 god.

Predmet: Izvještaj Komisije za doktorske studije

Komisija za doktorske studije MTF je razmotrila PD obrazac (Prijava teme doktorske disertacije) mr Zorane Sekulić pod nazivom " Uticaj prelaznih metala na strukturu i sorpcione osobine nanokompozita na bazi magnezijum hidrida" i zaključila da sadrži sve potrebne elemente navedene u Vodiču za doktorske studije Univerziteta Crne Gore, pa predlaže da se nastavi procedura za odobravanje TEME DOKTORSKE DISERTACIJE pod navedenim nazivom.

Inicijalni predlog je da članovi KOMISIJE ZA OCJENU TEME DOKTORSKE DISERTACIJE budu:

1. Dr Vanja Asanović, redovni profesor,Metalurško-tehnološki fakultet, Univerzitet Crne Gore
2. Dr Jasmina Grbović Novaković, Naučni savjetnik, Institut za nuklearne nauke " Vinča", Beogradu
3. Dr Nada Jauković , redovni profesor, Metalurško-tehnološki fakultet, Univerzitet Crne Gore

Spisak referenci predloženih članova komisije dat je u prilogu.

Podgorica, 08.09.2021.g.

KOMISIJA

Prof. dr Nada Jauković

Prof. dr Nada Blagojević

Prof. dr Zorica Leka

Na osnovu člana 32 stav 1 tačka 14 Statuta Univerziteta Crne Gore, u vezi sa članom 29 Pravila doktorskih studija, Senat Univerziteta Crne Gore, u postupku razmatranja prijedloga Vijeća Metalurško-tehnološkog fakulteta i na prijedlog Centra za doktorske studije, na sjednici održanoj 23-24.04.2020. godine, donio je sljedeću

O D L U K U

I

Dr Vanja Asanović, redovni profesor Metalurško-tehnološkog fakulteta Univerziteta Crne Gore **imenuje se za mentora** pri izradi doktorske disertacije **kandidatkinje mr Zorane Sekulić.**

II

Odluka stupa na snagu danom donošenja.

Broj: 03- 1593/2
Podgorica, 24.04.2020. godine

UNIVERZITET CRNE GORE 1974

PREDSJEDNIK SENATA

Prof. dr Danilo Nikolić, rektor

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Датум: 26.02.2009 г.

Ref: .....
Date, ...

Na osnovu člana 75 stav 2 Zakona o visokom obrazovanju (Sl.list RCG br. 60/03.) i člana 18 Statuta Univerziteta Crne Gore, Senat Univerziteta Crne Gore, na sjednici održanoj 26.02.2009. godine, donio je

O D L U K U
O IZBORU U ZVANJE

DR VANJA ASANOVIĆ bira se u akademsko zvanje **redovni profesor** Univerziteta Crne Gore za predmete: Fazne transformacije i Karakterizacija materijala na **Metalurško-tehnološkom fakultetu**.

REKTOR
Prof.dr Predrag Miranović

Prof. dr Vanja Asanović

BIOGRAFIJA

Rođena sam 14.10.1966. godine u Podgorici. Osnovnu i srednju školu (pomoćni istraživač u hemiji) završila sam u Podgorici. Dobitnik sam diplome „Luča" za postignut odličan uspeh iz svih nastavnih predmeta tokom osnovne i srednje škole, kao i drugih nagrada od kojih je najznačajnija „Zlatna medalja" na Festivalu rada omladine Jugoslavije (takmičenje srednjih škola) u Loznici 1984. godine za analitičku hemiju. Školske 1984/85. godine, proglašena sam za najboljeg srednjoškolca Podgorice i Crne Gore. Na Metalurški fakultet u Podgorici upisala sam se školske 1985/86. godine. Dobitnik sam nagrade „19. decembar" za školsku 1985/86. Diplomirala sam 1990. godine, sa prosečnom ocenom 9.20 i ocenom 10 na diplomskom radu.

Poslediplomske studije završila sam na Metalurško-tehnološkom fakultetu u Podgorici sa prosečnom ocjenom 9.60. Magistarski rad pod nazivom: *„Termoelastična martenzitna transformacija i efekat pamćenja oblika kod legura Cu-Zn-Al"* odbranila sam 08.07.1994. godine. Doktorsku disertaciju na temu: *„Uticajni faktori na kinetiku faznih transformacija i osobine Cu-Zn-Al legura sa efektom pamćenja oblika"* odbranila sam na Metalurško-tehnološkom fakultetu u Podgorici 26.03.1998. godine.

U okviru ***Oxford Colleges Hospitality Scheme*** u svojstvu ***Academic Visitor*** usavršavala sam se od 01.07. do 31.07.2006. godine, na Odseku za materijale (Department of Materials) Univerziteta u Oksfordu.

Učestvovala sam u nacionalnim i međunarodnim naučnim projektima kao član ili rukovodilac radnog tima, kao i stručnim i ostalim međunarodnim projektima (IPA, NEWEN, RENA, ECRAN). Član sam Upravnog odbora, kao predstavnica Crne Gore za COST akcije CA18112: *Mechanochemistry for Sustainable Industry,* CA18224: *Green Chemical Engineering Network towards upscaling sustainable processes* i CA19118: *High-performance Carbon-based composites with Smart properties for Advanced Sensing Applications.* Član sam Društva za istraživanje materijala Srbije.

Recenzirala sam radove objavljene u međunarodnim časopisima (Q1, Q2 i Q3): Journal of Materials Processing Technology, International Journal of Metalcasting, Environmental Engineering and Management Journal, Journal of Mining and Metallurgy, Section B: Metallurgy i Indian Journal of Engineering and Materials Sciences.

PODACI O RADNIM MESTIMA I IZBORIMA U ZVANJA

Na Metalurško-tehnološkom fakultetu sam zasnovala radni odnos 01.02.1991. godine. U zvanje asistenta-pripravnika na Katedri za fizičku metalurgiju, izabrana sam 16.01.1991. godine, a u zvanje asistenta na istoj Katedri, 08.06.1995. godine.

Kao asistent-pripravnik, odnosno asistent izvodila sam vežbe iz predmeta: *Metalografija, Termička obrada, Mašinski materijali* i *Materijali* na Metalurško-tehnološkom fakultetu i Mašinskom fakultetu, Univerziteta Crne Gore.

U zvanje docenta sam izabrana 05.10.1998. godine za predmet *Fizička metalurgija,* a u zvanje vanrednog profesora 25.12.2003. godine za predmete: *Fazne transformacije* i *Karakterizacija materijala.* Kao vanredni profesor bila sam angažovana na izvođenju nastave na Metalurško-tehnološkom fakultetu iz sledećih predmeta: *Fazne transformacije, Karakterizacija materijala, Mehanizam i kinetika faznih transformacija* i *Upravljanje otpadom.* U akademsko zvanje redovni profesor Univerziteta Crne Gore izabrana sam 26.02.2009. godine za predmete: *Fazne transformacije* i *Karakterizacija materijala* (odluka o izboru u zvanje br. 01-262). Kao redovni profesor bila sam angažovana na izvođenju nastave na Metalurško-tehnološkom fakultetu iz predmeta: *Struktura materijala, Fazne transformacije i Upravljanje otpadom* (osnovne studije), *Karakterizacija materijala* (specijalističke studije), *Fizička metalurgija (odabrana poglavlja), Kinetika i mehanizam faznih transformacija, Elektronska mikroskopija i X-ray mikroanaliza* (magistarske studije), *Karakterizacija materijala i Fizika materijala* (postdiplomske master studije). Izvodila sam nastavu i iz predmeta *Metrologija* na poslediplomskim magistarskim studijama na Mašinskom fakultetu u Podgorici. Studijske 2019/20., izvodila sam nastavu na doktorskim studijama: Metalurgija i materijali, na Metalurško-tehnološkom fakultetu iz predmeta: *Fazne transformacije (odabrana poglavlja)* i *Mehanizmi ojačavanja i dizajn materijala.*

U periodu od 2009. godine do danas, bila sam angažovana za pripremu izveštaja i uputstava u okviru različitih međunarodnih projekata iz oblasti zaštite životne sredine:

- Program for Capacity Building for Implementing the Law on Environmental Impact Assessment, Strategic Environmental Assessment and Integrated Prevention and Pollution Control in Montenegro - Guide for Implementation of the Law on Integrated Pollution Prevention and Control (Regional Environmental Center for Central and Eastern Europe - REC, 2009);
- Regional Environmental Network for Accession (RENA), Europe Aid/128906/C/SER/Multi (2013);
- Waste management in Montenegro: Preliminary Activities for Preparation of Waste Management Plan (2015);
- Overview of the current status of development of PRTR and implementation of the PRTR Protocol in Montenegro (Regional Environmental Center for Central and Eastern Europe - REC, 2015);
- Environment and Climate Regional Accession Network (ECRAN), CRIS 2013/024-094 and ARES (2013)555380 (2015/2016).

Predstavljala sam Metalurško-tehnološki fakultet u projektu NEWEN – Netherlands and Western Balkan Environmental Network, koji je realizovan od oktobra 2008. do maja 2011. godine. Projekat NEWEN je bio usmeren na povezivanje i razvoj prekogranične saradnje u upravljanju životnom sredinom između šest univerziteta sa Zapadnog Balkana i univerziteta i instituta iz Holandije.

U maju 2006. godine, Ministarstvo ekonomije je angažovalo radni tim, čiji sam bila član, a potom i rukovodilac, u cilju uspostavljanja Centra za metrologiju, odnosno organizovanja aktivnosti u oblasti naučne, zakonske i industrijske metrologije, kao i kontrole predmeta od dragocenih metala u okviru Zavoda za metrologiju. Kao direktorica, predstavljala sam Zavod za metrologiju, rukovodila organizacionim jedinicama i organizovala aktivnosti neophodne za izgrađivanje nacionalne metrološke institucije i njeno pozicioniranje u međunarodnim i regionalnim organizacijama. Od juna 2007. godine do 11.02.2021. godine, predstavljala sam Crnu Goru u relevantnim međunarodnim i regionalnim metrološkim organizacijama, kao delegat i član različitih radnih tela.

Učestvovala sam u pripremi predloga zakona i podzakonskih akata iz oblasti metrologije, nacrta Strategije razvoja metrologije u Crnoj Gori za period 2016-2018., komunikacionih strategija, dokumentacije sistema menadžmenta kvalitetom, kao i predstavljanju aktivnosti u okviru slobodnog protoka robe. U periodu od 2007. do 2017. godine, bila sam član Skupštine Instituta za standardizaciju Crne Gore. U Privrednoj Komori Crne Gore, kao član učestvovala sam u radu Savjeta za dodjelu žiga vizuelnog označavanja proizvoda iz Crne Gore (2009 – 2021.) i Koordinacionog odbora za kvalitet PKCG (2016 – 2020.).

Najznačajnije obuke koje sam pohađala u okviru međunarodnih projekata odnose se na upravljanje otpadom, zaštitu životne sredine, metrologiju, strateško upravljanje, kvalitet i primenu standarda.

Nakon imenovanja za vršenje javne funkcije – direktorice Zavoda za metrologiju, u periodu od 01.09.2010. do 11.02.2021. godine, na Univerzitetu Crne Gore sam bila angažovana u skladu sa ugovorom o dopunskom radu. Nakon isteka mandata 11.02.2021. godine, ugovor o dopunskom radu na Univerzitetu Crne Gore je prestao da važi.

NAUČNO-ISTRAŽIVAČKA DELATNOST

Naučno-istraživački rad sam usmerila na sintezu, termo-mehaničku obradu, fazne transformacije i strukturna ispitivanja novih materijala – legura Cu-Zn-Al koje ispoljavaju efekat pamćenja oblika, kao i termičku obradu, fazne transformacije i karakterizaciju čelika i legura aluminijuma. Kao autor ili koautor objavila sam 27 radova u međunarodnim naučnim časopisima, 5 u nacionalnim naučnim časopisima,

43 rada na međunarodnim naučnim konferencijama i 16 na nacionalnim konferencijama. Koautor sam jednog univerzitetskog udžbenika.

U periodu od 1994. do 2007. godine bila sam angažovana kao saradnik na dva naučno-istraživačka projekta, a rukovodila sam sledećim naučno-istraživačkim projektima koje je finansiralo Ministarstvo prosvjete i nauke Crne Gore iz oblasti razvoja novih materijala (legure koje ispoljavaju efekat pamćenja oblika):

- „Uticaj mikrolegiranja na kinetiku faznih transformacija i drugih promjena u strukturi legura sa efektom pamćenja oblika" (2000. godina).
- „Istraživanje uticaja legirajućih elemenata i termomehaniče obrade na substrukturu, mehaničke osobine i stepen oporavljanja oblika memorijskih legura na bazi bakra" (2005/2007).

U toku 2009. i 2010. godine kao saradnik na potprojektu „Životna sredina i održivi razvoj" u okviru projekta Crnogorske akademije nauka i umjetnosti „Crna Gora u XXI stoljeću – u eri kompetitivnosti" učestvovala sam u pripremi poglavlja *Kvalitet životne sredine.*

U okviru programa naučne i tehnološke bilateralne saradnje Crna Gora – Republika Srbija za period 2019-2020, rukovodilac sam projekta: „Sinteza i karakterizacija PCM (fazno promjenljivih materijala) materijala – put ka ekonomiji baziranoj na vodoničnoj energetici".

PEDAGOŠKA DELATNOST

UDŽBENIK

Radulović Branko, **Vanja Radusinović-Asanović** „Praktikum iz termičke obrade metala", Univerzitet Crne Gore, MTF, Podgorica, 1997.

MENTORSTVO:

Magistarske master studije:

- Raonić Milena – magistarski rad *„Istraživanje uticajnih faktora na izbor i prikladnost metode za utvrđivanje stepena finoće u sistemu kontrole predmeta od dragocjenih metala u Crnoj Gori* " odbranjen 2017. godine na Mašinskom fakultetu, Univerziteta Crne Gore.

Doktorske studije:

- Zorana Sekulić – doktorand, Metalurško-tehnološki fakultet, Univerzitet Crne Gore, Odluka Senata Univerziteta Crne Gore br.03-1593/2 od 24.04.2020.

Prof. dr Vanja Asanović

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2. **Asanović V.,** Perović B., Marković Z., Vušanović I., Kostov A., "The Influence of Heat Treatment on Shape Memory Effect", *Materials Science Forum: Trends in Advanced Materials and Processes* , Vol. 352, (2000) pp. 165-170, Trans.Tech. Publication, Switzerland.
3. Radulović B., Bošnjak B., Harding R., Pop-Tonev K., **Asanović V.,** "The Influence of Austenitising Temperature on the Microstructure and Mechanical Properties of Low-Alloyed Ni-Mo-Cu Austempered Ductile Iron", *Materials and Technology*, 34 (5), (2000) pp. 207-212.
4. Bošnjak B., Radulović B., Pop-Tonev K., **Asanović V.,** "Microstructural and Mechanical Characteristics of Low-Alloyed Ni-Mo-Cu Austempered Ductile Iron", *ISIJ International*, Vol. 40, No 12 (2000) pp. 1246-1252.
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7. **Asanović V.,** Delijić K., Leka Z., "Aging Effects in Cu-Zn-Al Shape Memory Alloy", *Materials Science Forum: Progres in Advanced Materials and Processes* , Vol. 453-454, (2004) pp. 187-193, Trans.Tech. Publication, Switzerland.(ISBN: 0-87849-940-7)
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11. Delijić K., **Asanović V.,** Radonjić D., "Mechanical Behavior and Corrosion Properties of AA8079 Sheets", *Journal of the Mechanical Behavior of Materials,* Vol. 17, No. 1 (2006) pp. 1-15, Freund Publishing House Ltd., Israel.
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15. Jauković N., **Asanović V.,** "The effect of temper and chemical composition on polarization resistance of aluminum RR58 alloy", *Journal of Materials Processing Technology Vol. 174, Issues 1-3* (2006), *pp 293-295,Elsevier Science B.V., Lausanne, Switzerland*
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21. Jauković N., **Asanović V.,** Radović Ž., "Mechanical Properties and Microstructure of Aluminum 2618 Alloy Containing Manganese and Chromium", *High Temperature Materials and Processes*, Vol. 28, Issue 4, Aug 2009, pp. 253-262, ISSN (Online) 2191-0324, ISSN (Print) 0334-6455,
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Poglavlje u monografiji nacionalnog značaja

1. Šuković D., **Asanović V.,** Damjanović-Vratnica B., Radulović M. „Kvalitet životne sredine", u monografiji „Crna Gora u XXI stoljeću – u eri kompetitivnosti", urednik Momir Đurović, CANU, str. 345-410, knj. 73, sv. 1, 2010, ISBN 978-86-7215-247.

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Radovi na međunarodnim naučnim konferencijama (štampani u celini)

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2. **Asanović V.,** Perović B., Delijić K., Kostov A., "Optimization of parameters of Cu-Zn-Al memory annealing of memory alloys with the aim of increasing plasticity", *Book of Papers of XXX October Counseling of Miners and Metallurgists with International Participation,* Donji Milanovac, October. 1998, Volume II, p. 245-250.
3. **Asanović V.,** Perović B., Radusinović I., "The effects of thermal treatment on the structure of Cu-Zn-Al alloys", *Proceed. of the International Symposium on Shape Memory Alloys: Fundamentals, Modeling and Industrial Applications;* Quebec City, Quebec, Canada, Aug. 1999, p. 185 - 199.
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11. **Asanović V.,** Delijić K., "The Mechanical Behaviour and Shape Memory Recovery of Cu-Zn-Al Alloys", *4th Balkan Conference on Metallurgy: Scientific achievements and perspectives of metals industry in South-East Europe,* Proceedings, Zlatibor, Serbia, 27-29 September 2006, p. 451-456
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14. J. Šćepanović, D. Radonjić, D. Vuksanović, **V. Asanović**, "Selection of modern technology in the process of municipal waste disposal", XX YuCorr, May 21-24, 2018, Tara Mountain, Serbia, pp. 173-178. ISBN 978-86-82343-26-4.
15. Vuksanovic D., **Asanovic V.,** Cvijovic Z., Scepanovic J., Radonjic D."Microstructure and fracture analysis of T6 treated hypereutectic Al-13.5Si alloy for IC engine components," MCM2019, 14th Multinational Congress on Microscopy, Belgrade, Serbia, September 15-20, 2019, p. 357-359.

Radovi na međunarodnim naučnim konferencijama (štampani u izvodu)

1. **Asanović V.,** Perović B., "Investigation of shape memory effect appearance in copper-zinc-aliminum alloys", *Proceed. Of METAL '97, 6th International Symposium,* Ostrava, Czech Republic, May 1997., p. 208.

2. **Asanović V.,** Perović B., "Investigation of thermoelastic martensitic transformation in Cu-18.05Zn-5.35Al shape memory alloy during isothermal annealing", *Proceed. Of METAL '98, 7th International Symposium,* Ostrava, Czech Republic, May 1998., p. 175.
3. **Radusinović-Asanović V.,** Perović B., Adžić R., "The effect of quenching conditions on the properties of Cu-21.6Zn-5.64Al shape memory alloy", *Proceed. Of METAL '99, 8th International Symposium,* Ostrava, Czech Republic, May 1999.
4. **Asanović V. D.,** Perović B. F., Marković Z. B., Kostov A. I., Vušanović I. Ć., "Thermoelastic Martensitic Transformation and Form Memory Effect in Cu-Zn-Al Alloys", *Proceedings of the Yugoslav Congress of Food, Pharmaceutical and Chemical Engineering with International Participation,* Novi Sad, September, 1999. p. 259.
5. **Asanović V.,** Perović B., Marković Z., Vušanović I., Kostov A. I "The Impact of Thermal Treatment on the Form Memory Effect," *Proceedings of the Third Conference of the YUCOMAT'99 Materials Research Society with International Participation,* Herceg Novi, Sept. 1999. p. 166.
6. **Asanović V.,** Perović B., "Application of Memory Alloys in Medicine and Dentistry", *Proceedings of the Abstracts of the Third Conference of the Materials Research Society YUCOMAT'99 with International Participation,* Herceg Novi, September, 1999. p. 68.
7. Marković Z., Sabo T., **Asanović V.,** Trifunović S "Synthesis and Characterization of the Ni (II) Complex with Imino-Diacetato-Dithiocarbamate (idadtc) Ligand", *Proceedings of the Third Conference of the YUCOMAT99 Materials Research Society with International Participation,* Herceg Novi, September, 1999. p. 86.
8. Adžić R., Radulović B., **Asanović V.,** "SEM fracture of cemented sample after bending test", *Proceedings of the Abstracts of the Third Conference of the Materials Research Society YUCOMAT'99 with International Participation,* Herceg Novi, September 1999. pp. 174.
9. **Asanović V.,** Perović B., Marković Z., Kostov A., Todorović R., "Kinetics of deposition in some Cu-Zn-Al memory alloys", *Proceedings of the XXXI October Counseling of Miners and Metallurgists,* Bor, Oct. 1999., p. 152.
10. Kostov A., Todorović R., Arsenović M., **Asanović V.,** "Obtaining Copper Wire from Shape Memory Materials," *Proceedings of the XXXI October Conference of Miners and Metallurgists,* Bor, Oct. 1999., p. 160.
11. **Asanović V.,** Perović B., Delijić K., Kostov A., "Tensile tests and investigation of shape memory recovery of Cu-15.75Zn-5.37Al alloy *Proceed. of METAL 2000, 9th International Symposium,* Ostrava, Czech Rep., May 2000.
12. **Asanović V. D.,** Marković Z. B., Vušanović I. Ć., Bošnjak B. T., Radulović B., Kostov A. I., "Isothermal decomposition of β_1 phase in a Cu-Zn-Al shape memory alloy", *Book of Abstracts - 2nd International Conference on "Chemical Sciences for Sustainable Development",* Halkidiki, Greece, June 2000,Vol II, p. 2.
13. Marković Z., Tešić Z., Sabo T., **Asanović V.,** Trifunović S., "Preparation and properties of complexes Pt(II) and Pd(II) with N-dithiocarboxy-iminodiacetic acid (idadtc) as ligand", *Book of Abstracts - 2nd International Conference on "Chemical Sciences for Sustainable Development",* Halkidiki, Greece, June 2000,Vol I, p.242.
14. Bošnjak B., Radulović B., **Asanović V.,** "The Influence of Austenitising Temperature on Impact Properties of Ni-Mo-Cu Austempered Ductile Iron", *2nd International Conference on "Chemical Sciences for Sustainable Development",* Halkidiki, Greece, June 2000.

15. Marković Z., Bogdanović G. A., Spasojević-de Bire A., **Asanović V.**, Sabo T., Trifunović S., "Crystal structure of ammonium iminodiacetate", *8th Conference of the Serbian Crystallographic Society - Abstracts*, Kragujevac, 2000, p. 41-42.
16. **Asanović V.**, Delijić K., Leka Z., "Aging effects in Cu-Zn-Al Shape Memory Alloy", *The Book of Abstracts of Fifth Yugoslav Materials Research Society Conference, YUCOMAT 2003*, Herceg Novi, Jugoslavija, sept. 2003., str.20.
17. Delijić K., Asanović V., Radonjić D., "DOWNSTREAM PROCESSING OF SOME Al-Fe-Mn-Si AND Al-Fe-Si ALLOYS AND ITS INFLUENCE ON THE SHEET/FOILS PROPERTIES", *The Book of Abstracts of Seventh Yugoslav Materials Research Society Conference, YUCOMAT 2005*, Herceg Novi, Serbia and Montenegro, September 12-16, 2005., pp.102.
18. Delijić K., **Asanović V.**, Radonjić D., "Mechanical Behavior and Corrosion Properties of Some AA6xxx Aluminum Alloys in T5 Temper", *Book of Abstracts – 1st South East European Congress of Chemical Engineering*, September 25-28, 2005, Belgrade, Serbia and Montenegro, pp. 275.
19. Delijić K., **Asanović V.**, Radonjić D., "Thermomechanical Processing of Some AA6xxx Alloys for Improved Mechanical and Corrosion Properties", *Book of Abstracts – 12th International Metallurgy –Materials Congress and Fair*, 28th September – 02nd October 2005, Istanbul, Turkey.
20. Delijic K., **Asanovic V.**, Radonjic D., "The effect of thermo-mechanical processing on the properties of some Al-Fe-Si alloys with high Fe/Si ratio", *The Eight YU Materials Research Society Conference*, Herceg Novi, Sept 2006, Proc p.88, ISBN 86-80321-09-5, poster presentation.
21. **Asanovic V.**, Delijic K., Jaukovic N., "Heat treatment effects in a copper based shape memory alloy", *The Eight YU Materials Research Society Conference*, Herceg Novi, Sept 2006, Proc p.113, ISBN 86-80321-09-5, poster presentation.
22. **Asanović V.**, Delijić K., Bosnjak B., "THE PLATE FORMING PROCEDURE OF THE COPPER-BASED SHAPE MEMORY ALLOY", *The Book of Abstracts of 5th International Conference of the Chemical Societies of the South-East European Countries: Chemical Sciences at the European Crossroads*, Ohrid, Former Yugoslav Republic of Macedonia, September 10-14, 2006. vol II, pp.344.
23. **Asanović V.**, Delijić K., Jauković K., "A Study of transformations of β-phase in Cu-Zn-Al shape memory alloys", *The Book of Abstracts of Materials Today Asia*, Beijing, China, September 3-5, 2007, poster presentation P2.63.
24. Jauković N., **Asanović V.**, "The investigation of aluminum 2618 alloy containing lanthanides", *The Book of Abstracts of Materials Today Asia*, Beijing, China, September 3-5, 2007, poster presentation P2.64.
25. Delijic K., **Asanović V.**, "Effect of the chemical composition and Fe/Si rations in some Al-Fe-Si-Mn aluminum alloys on its mechanical and corrosion properties", *The Book of Abstracts of Materials Today Asia*, Beijing, China, September 3-5, 2007, poster presentation P2.82.
26. **Asanović V.**, Jauković N., Delijić K., "Quenching effects in Cu-based shape memory alloy", *8th International Symposium of Croatian Metallurgical Society SHMD 2008*, Sibenik, Hrvatska, jun 22-26, poster presentation, section A.
27. **Asanovic V.**, Delijic K., "The Effects of Aging on the Martensitic Transformation Temperature and Shape Memory Recovery of Cu-25,7Zn-3,1Al Alloy", International Scientific Conference Contemporary Materials 2012, Banja Luka, July 2012, poster presentation.
28. Delijić K., **Asanovic V.**, Šuković D., "Investigation od Used Grit Cement Stabilization for Safe Disposal", Book of Abstracts, *22nd Congress of SCTM with international participation*, 5 – 9 Sept. 2012, Ohrid, Macedonia, pp. 235.

Radovi na nacionalnim naučnim konferencijama (štampani u celini)

1. Perović B., **Radusinović V.,** "Development of copper alloys exhibiting the effect of shape memory", *Proceedings of the Memorial Scientific Conference, "Metallurgy '94 Budva",* Oct 1994, pp. 340 - 345.
2. **Radusinović V.,** Perović B., Delijić K., Rakić J., Lučić V., "Research of the occurrence of shape memory effect on Cu-Zn-Al alloys", *Proceedings of the Memorial Scientific Conference "Metallurgy '94", Budva,* Oct. 1994, p. 346- 351.
3. **Radusinović-Asanović V.,** Perović B., Jaćimović Ž., Rakić J., "X-ray examination of the crystal structure of martensite in copper-based alloys exhibiting shape-memory effects", *Proceedings of the XXVII October Counceling of Miners and Metallurgists,* Bor, Oct. 1995, p. 518 - 521.
4. Perović B., **Asanović V.,** "Development of shape-memory alloys and their application," *Proceedings of the colloquial scientific conference "Foundry '96",* Budva, Oct. 1996, p. 1 - 13.
5. **Asanović V.,** Perović B., Kostov A., Todorović R., "Melting and Casting Characteristics of Cu-Zn-Al Alloys That Express the Effect of Form Memory", *Proceedings of the Colloquial Scientific Meeting "Foundry '98",* Budva, Oct. 1998, p. 57 - 68.

Radovi na nacionalnim naučnim konferencijama (štampani u izvodu)

1. Radulović B., **Radusinović V.,** Adžić R., "Kinetics of oxidation of iron-based alloys in high-temperature operating conditions", *Proceedings of the IXth Yugoslav Congress of Chemistry and Chemical Technology,* Herceg Novi, May 1992, p. IV - 15.
2. Radulović B., **Radusinović V.,** Adžić R., "Decarbonization of the Surface Layer in the Carbonization Process", Proceedings of the IX Yugoslav Congress of Chemistry and Chemical Technology, Herceg Novi, May 1992, p. IV - 14.
3. **Radusinović V.,** Perović B., Rakić J., "Determination of critical temperatures of As and Af in copper-based alloys exhibiting shape memory effect", *Book of Work Excerpts of XXVI October Counceling of Miners and Metallurgists,* Donji Milanovac, October. 1994, p. 99.
4. **Radusinović V.,** Perović B., Rakić J., Šerbula M., "Isothermal annealing of an alloy exhibiting the effect of shape memory (Cu-18.05Zn-5.35Al) ", *Proceedings of Synopsis II of the Counseling on the Application of Scientific Research and Design Solutions in Metallurgy,* Nikšić, Apr. 1995, p. 140.
5. Blečić Ž., Kontić R., **Asanović V.,** "Induction Hardening of Pre-thermomechanically Treated Steel Č.1531", *Proceedings of Synopsis II of the Consultation on the Application of Scientific Research and Design Solutions in Metallurgy,* Nikšić, Apr. 1995, p. 33.
6. **Asanović V.,** Perović B., Delijić K., Todorović R., "Influence of different tempering processes on the properties of Cu-Zn-Al memory alloys, *Proceedings of the IV Counseling Synopsis on the Application of Scientific Research and Design Solutions in Metallurgy,* Zlatibor, Oct 1999, p. 31.
7. Adžić R., Radulović B., **Asanović V.,** "Influence of factors, during cementation, on the wear resistance of steel Č.5420", *Proceedings of the IV Counseling on the Application of Scientific Research and Design Solutions in Metallurgy,* Zlatibor, Oct. 1999., p. 110.

8. **Asanović V. D.,** Perović B. F., Marković Z. B., Vušanović I. Ć., "Effect of aging on the memory effect of Cu-25.38Zn-3.3Al 3.3 alloy shape, *Proceedings of the XXXIX Conference of the Serbian Chemical Society*, Belgrade, October. 1999., p. 46.
9. Marković Z., Sabo T., **Asanović V.,** Trifunović S., "Synthesis and characterization of the Cu (II) complex with imino-diacetato-dithiocarbamate ligand", *Proceedings of the XXXIX Conference of the Serbian Chemical Society*, Belgrade, Oct. 1999., p. 168.
10. Bošković T., Boričić M., **Asanović V.**, "Interlaboratory Comparison in South Eastern Europe - SEE Mass Comparison", XIII Conference SQM2009, Tivat, September 2009.
11. Bošković-Begenišić T., Vukoslavović G., **Asanović V.,** "Interlaboratory Comparison in the Field of Mass. 4- 2011 organized by the Department of Metrology ", XV Conference SQM2011, Tivat, 19-21. September 2011.

STRUČNA DELATNOST

Međunarodni projekti iz oblasti zaštite životne sredine

1. ***Person responsible for report:***
   Data Sheets for Vehicle Fuels and Emissions Country Assessment under projects: Capacity Building for Improvement of Vehicle Fuel Quality in the SEE Countries and Addressing Clean Fuel and Vehicles Issues in Central and Eastern Europe and Turkey (REC, 2005).
2. ***Engaged expert:***
   Developing activities for Protocol on Pollutant Release and Transfer Registers – PRTR Protocol in Montenegro, Aarhus project (REC, 2006).
3. ***Engaged expert:***
   Report of Implementation of the European Parliament and of the Council Providing for Minimum Criteria for Environmental Inspection in Montenegro (REC, 2006).
4. ***Engaged expert:***
   Program for Capacity Building for Implementing the Law on Environmental Impact Assessment, Strategic Environmental Assessment and Integrated Prevention and Pollution Control in Montenegro - Guide for Implementation of the Law on Integrated Pollution Prevention and Control (REC, 2009)
5. ***A representative of the Faculty of Metallurgy and Technology in the project NEWEN*** aimed to develop a network and transboundary cooperation in environmental management between the six participating Universities in the Western Balkans (WB) and the participating Universities and institutes in the Netherlands. Project NEWEN ran from October 2008 to May 2011 and was financially supported by the Dutch Ministry of Foreign Affairs.
   - *The first regional Workshop on Urban Solid Waste Management (11-12 June, 2009, Durres, Albania).*
   - *Tailor made course for University staff: Course on Hazardous Waste Management (21-25 September 2009, Delft,* Netherlands*).*
   - *The third regional workshop on Lake Pollution Management (8-9 March 2010).*
6. ***Junior short term expert:***
   Regional Environmental Network for Accession (RENA), Europe Aid/128906/C/SER/Multi (2013)

7. ***Engaged expert:***
   Environment and Climate Regional Accession Network – ECRAN (2014)
8. ***Engaged expert:***
   Waste management in Montenegro: Preliminary Activities for Preparation of Waste Management Plan (2015).

Република Србија
МИНИСТАРСТВО ПРОСВЕТЕ,
НАУКЕ И ТЕХНОЛОШКОГ РАЗВОЈА
Комисија за стицање научних звања

Број:660-01-125/2013-17
17.07.2013. године
Б е о г р а д

На основу члана 22. става 2. члана 70. став 7. Закона о научноистраживачкој делатности ("Службени гласник Републике Србије", број 110/05 и 50/06 – исправка и 18/10), члана 2. става 1. и 2. тачке 1 – 4.(прилози) и члана 38. Правилника о поступку и начину вредновања и квантитативном исказивању научноистраживачких резултата истраживача ("Службени гласник Републике Србије", број 38/08) и захтева који је поднео

Институт за нуклеарне науке "Винча" у Београду

Комисија за стицање научних звања на седници одржаној 17.07.2013. године, донела је

ОДЛУКУ
О СТИЦАЊУ НАУЧНОГ ЗВАЊА

Др Јасмина Грбовић Новаковић
стиче научно звање
Научни саветник

у области природно-математичких наука - физичка хемија

О Б Р А З Л О Ж Е Њ Е

Институт за нуклеарне науке "Винча" у Београду

утврдио је предлог број 678/4 од 21.02.2013. године на седници научног већа Института и поднео захтев Комисији за стицање научних звања број 678/8 од 05.03.2013. године за доношење одлуке о испуњености услова за стицање научног звања ***Научни саветник***.

Комисија за стицање научних звања је по предходно прибављеном позитивном мишљењу Матичног научног одбора за хемију на седници одржаној 17.07.2013. године разматрала захтев и утврдила да именована испуњава услове из члана 70. став 7. Закона о научноистраживачкој делатности ("Службени гласник Републике Србије", број 110/05 и 50/06 – исправка и 18/10), члана 2. става 1. и 2. тачке 1 – 4.(прилози) и члана 38. Правилника о поступку и начину вредновања и квантитативном исказивању научноистраживачких резултата истраживача ("Службени гласник Републике Србије", број 38/08) за стицање научног звања ***Научни саветник***, па је одлучила као у изреци ове одлуке.

Доношењем ове одлуке именована стиче сва права која јој на основу ње по закону припадају.

Одлуку доставити подносиоцу захтева, именованој и архиви Министарства просвете, науке и технолошког развоја у Београду.

ПРЕДСЕДНИК КОМИСИЈЕ
др Станислава Стошић-Грујичић,
научни саветник

МИНИСТАР
Проф. др Жарко Обрадовић

Ime I prezime: Jasmina Grbović Novaković

Naučno zvanje/datum sticanja	**naučni savetnik/17.07.2013**
Afilijacija:	**Institut za nuklearne nauke Vinča, Institut od nacinonalnog značaja za Republiku Srbiju, Univerzitet u Beogradu, Laboratorija za fiziku POB 522 Belgrade 11 000 Serbia**
Trenutna pozicija:	**Rukovodilaca Centra izuzetnih vrednosti za vodoničnu energetiku I obnovljive izvore energije Koordinator Programskog saveta Instituta Vinča**
Ranije pozicije:	**Pomoćnik direktora za nauku u Laboratoriji za fiziku**
Citiranost i h faktor:	**1249 and 22 (Google Scholar)**
Istraživačko intersovanje:	Mehanohemijska sinteze matarijala Modifikacija materijala josnkim snopom Razvoj materijala za skladištenje vodonika Razvoj opreme za karakterizaciju materijala Razvooj materijala za elektrohemijske senzore
E-mail:	jasnagn@gmail.com. jasnag@vinca.rs
Publikacije:	Autor je više od 180 publikacija od toga 51 u međunarodnim časopisima, 125 saopštenja na konferencijama, 8 pozivnih predavanja i 3 poglavlja u monografijama

OBRAZOVANJE

Osnovnu i srednju školu završila je u Beogradu

1999	Diplomirala je na Fakultetu za fizičku hemiju Univerziteta u Beogradu.
2003	Magistrirala je na Fakultetu za fizičku hemiju Univerziteta u Beogradu, tema: Karbon/karbon kompoziti kao nosači kiseonične elektrode za primenu u Zn/vazduh gorivnim ćelijama,
2005	Doktorirala na Fakultetu za fizičku hemiju Univerziteta u Beogradu, tema: Kinetika formiranja hidrida u sistemima Mg-C, Mg-Fe i Mg-C-Pd.
2008	Posledoktorsko usavršavanje u Italiji (CR ENEA Casaccia)

MENADŽMENT PROJEKATA SARADNJE NAUKA -PRIVREDA

2018 - Rukovodilac projekata: Use of natural clays as electrochemical sensors

2018 - Rukovodilac projekata: Hydrogen storage in composite materials based on minerals

MENADŽMENT NACIONALNIH PROJEKATA

2020-2021 **Rukovodilac of Proof of Concept project:** From modified pyrophyllite - natural clay to electrochemical sensors for detection of pesticide traces in food and water (Project Id=5415)- Innovation fund of Serbia

2017-2018 Rukovodilac of **Technology transfer facility project - Hydrogen Storage Analyser** Innovation Fund of Serbia

2010-2018 Rukovodilac potprojekta: Experimental and theoretical investigation of materials for hydrogen storage at project Synthesis, processing and characterization of nanostructured materials for application in the fields of energy, mechanical engineering, environment and biomedicine

2006-2010 Rukovodilac radnog zadatka: Synthesis and modification of magnesium based materials for hydrogen storage, within national project Synthesis and characterisation of nanostructurated metallic and intermetallic compounds and their composites"

MENADŽMENT INTERNACIONALNIH PROJEKATA

2019-2023 MC member of **COST ACTION CA18112** - Mechanochemistry for Sustainable Industry

2019-2021 MC member of **COST Action IG15102** - Title Innovative and sustainable TecHnologies for reducing critical raw materials dependence for Cleaner transportation Applications

2015-2019 MC member of **COST ACTION CA15102** Solutions for Critical Raw Materials Under Extreme Conditions

2019-2020 **Bilateral project Serbia-Montenegro** Synthesis and characterization of PCM (phase change materials) materials: the path to a hydrogen energy-based economy according

2016-2017 **Bilateral project Serbia-France** Nanostrucured composite materials for solid state hydrogen storage

2016-2017 **Bilateral project Serbia –Croatia** Amonium boranes and its derivatives for solid state hydrogen storage

2011-2015 MC member and in charge for Early stage researchers (ESR) and small term scientific missions (STSM) at **COST Action MP1103 Nanostructured materials for solid-state hydrogen storage**

2010-2012 **Bilateral project Serbia -Spain:** Effects of low energy ion irradiation on the catalytic activity magnesium and magnesium based intermetallic compounds

2010-2012 **Bilateral project Serbia -Russia:** 'Ion beam induced nanostructuring of silicon based and materials for hydrogen storage (WP leader)

2009 **International project** Inelastic neutron scattering study of the microscopic proton dynamics in ion-bombarded MgH_2

UČEŠĆE U NACIONALNIM PROJEKTIMA

2010 - 2018 Synthesis, processing and characterization of nanostructured materials for application in the fields of energy, mechanical engineering, environment and biomedicine"

2006 - 2010 Synthesis and characterisation of nanostructurated metallic and intermetallic compounds and their composites"

2002 - 2005 New carbon materials and their composites

UČEŠĆE U INTERNACIONALNIM PROJEKTIMA

2012-2013 **Bilateral project Serbia - Slovenia**: Microstructural investigation of materials for hydrogen storage and correlation with desorption properties

2010-2012 **Bilateral project Serbia - Russia:** Ion beam induced nanostructuring of silicon based and materials for hydrogen storage

EVALUATOR PROJEKATA

2020 Evaluator for **National Entity for Accreditation and Quality Assurance in Higher Education of Serbia - NEAQA**

Evaluation of the Baltic Research Programme

Certified evaluator for IPA project

Evaluator of project related to Funding Multilateral Scientific and Technological Cooperation Projects in the Danube Region

Evaluator of project related to Funding Bilateral Project funded by Serbian Ministry of Education, Science and Technological Development

RECENZENT U MEĐUNARODNIM ČASOPISIMA

International Journal of Hydrogen Energy, Journal of Power Sources, Journal of Alloys and Compounds Ultrasonic Sonochemistry, Journal of Materials Research, Hemijska industrija, Materials Science, Processing and Applied Ceramics, Environmental Engineering and Management Journal, Journal of Nanoscience...

ČLANSTVO U TELIMA I KOMISIJAMA, RUKOVOĐENJE DRUŠTVIMA

2020 - **Member of National commission for acquisition of scientific titles**
2019 - **Coordinator of Programe Board of Vinča Institute of Nuclear Sciences**
2019 - **Member of Council of Institutes at Belgrade University**
2018 - **Director of Centre of Excellence for Hydrogen and Renewable Energy**
2017 - **Member of Advisory Board of Hydrogen Economy Initiative Serbia**
2010 -2020 – **President of Serbian Society for Microscopy**
2006-2010 – **Secretary General of Serbian Society for Microscopy**
2008-2010 – **Secretary General of Vinca Institute Scientific Council**
Faculty leader of **Hydrogen storage Student Chapter**

ČLANSTVO U PROGRAMSKIM I ORGANIZACIJONIM ODBORIMA KONFERENCIJA

- President and member of program and organizing committee 14th Multinational Conference on Microscopy MCM2019 Belgrade, Serbia 15-20.9.2019
- President and member of program and organizing committee of 3rd International Symposium on Energy Storage and Conversion Belgrade, Serbia 10-12.10.2018
- President and member of program and organizing committee of the Joint meeting of 11th Conference of Young Researchers in Field of Material Science and the 1st European Early Stage Researchers Conference of Hydrogen Storage, 03-05. 12. 2012, Belgrade, Serbia
- Member of program committee of the 10th Conference of Young Researchers in Field of Material Science, 21-23. 12. 2011, Belgrade, Serbia
- Member of organizing committee of the 7th International Conference on Mechanochemistry and Mechanical Alloying, 31.8-04.09. 2011, Herceg Novi, Montenegro

- Member of Program committee of 11th Multinational Conference on Microscopy 04.-09.09.2011, Urbino, Italy
- Member of program committee of the 1st Conference of the Serbian Ceramic Society, 17-18. 03.2011, Belgrade, Serbia
- Member of Program and Organizing board of 4th Serbian Congress on Microscopy, Belgrade 11-12. October 2010
- Member of program committee of the 9th Conference of Young Researchers in Field of Material Science, 20-22. 12. 2010, Belgrade, Serbia
- Member of program committee of the 8th Conference of Young Researchers in Field of Material Science, 21-23. 12. 2009, Belgrade, Serbia
- Member of Program committee of Joint meeting of 9th Multinational Conference on Microscopy 2009 and Dreiländertagung 2009 and chairman on the session M7, Graz, Austria
- Member of Program committee of National Conference: 7th Conference of Young Researchers in Field of Material Science, Belgrade, Serbia
- Member of Program and Organizing board of 3rd Serbian Congress on Microscopy, Belgrade, 2007
- Member of Program and Organizing board of national meeting on ''50 years of Electron Microscopy in Serbia''

MEĐUNARODNI MENTOR PHD TEZA

2021- Supervisor of PhD thesis of Mr. Jing Wang on solid state hydrogen storage at the School of Chemical Engineering of Technology of Xi'an Jiaotong University, China

MENTOR TEZA

2016- PhD thesis of S.Milošević, Faculty of Physical Chemistry, University of Belgrade
Theme: Usage of VO_2(B) as a catalyst in the dehydration reaction of MgH_2 and as an intercalate material in lithium batteries
2015 PhD thesis of S.Kurko, Faculty of Physical Chemistry, University of Belgrade
Theme: Influence of boron induced modification in MgH_2 structure on dehydrogenation process
2015 PhD thesis of I. Milanović, Faculty of Physical Chemistry, University of Belgrade
Theme: Synthesis and characterization of complex and metallic hydrides for hydrogen energy applications
2010 PhD thesis Lj.Matović, Faculty of Physical Chemistry, University of Belgrade
Theme: Change of thermal properties of MgH_2 induced by high-energy ions structural destabilization

EDITOR ČASOPISA, PROCEEDINGS I KNJIGA

2020 Guest editor of International Journal of Hydrogen Energy–Special issue,
2018 Editor of book Programme and the book of abstracts form 3rd International Symposium on Materials for Energy Storage and Conversion - mESC-IS 2018
2016 Editor of book Program and the Book of Abstracts from Workshop of French, Croatian and Serbian Researchers on Hydrogen Storage and Energy Related Materials
2013 Guest editor of International Journal of Hydrogen Energy–Special issue,
2012 Guest editor of book: Novel Perspectives on Hydrogen Storage in Solid Media
2011 Editor of book of abstracts from The 1st Conference of the Serbian Ceramic Society,
2010 Editor of book of abstracts from The 4th Serbian Congress for Microscopy
2007 Editor of book of abstracts from The 3rd Serbian Congress for Microscopy
2006 Editor of Monograph 50 years of electron microscopy in Serbia

NAGRADE

2020 Congress Ambassador of Serbia
2018 The best entrepreneur idea Cider of Quince at Pokreni se za posao
2017 Third place at National Forum of Green Ideas for social entrepreneurship
2009 IAHE outstanding Service Award International Association of Hydrogen Energy
2009 IUPAP (International Union of Pure and Applied Physics) Women in Physics Grant
2005 S.I.S.M. grant for best paper on Multinational conference on microscopy
2003 The best poster on the YUCOMAT2003 conference

KNJIGE I POGLAVLJA U KNJIGAMA

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O D L U K U
O IZBORU U ZVANJE

Dr NADA JAUKOVIĆ bira se u akademsko zvanje **redovni profesor** Univerziteta Crne Gore za predmete: Fizika čvrstoće i plastičnosti i Kristalografija na **Metalurško-tehnološkom fakultetu,**

REKTOR
Prof. dr Predrag Miranović

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BIOGRAFIJA

Rođena sam 30.03.1955. godine u Ivangradu. Osnovnu školu i Gimnaziju završila sam u Titogradu. Za postignuti uspjeh u toku školovanja i na završnom ispitu dobila sam diplomu „Luča". Petogodišnje studije na Metalurškom odsjeku Tehničkog fakulteta u Titogradu sam upisala 1973. godine. Studije sam završila u redovnom roku, 1978. godine, sa srednjom ocjenom 9.46, a diplomirala sa ocjenom 10. Kao najbolji student Univerziteta „Veljko Vlahović" dobitnik sam Povelje za 1975. godinu. Za izuzetni uspjeh na studijama, kao najbolji student Tehničkih fakulteta, dobila sam nagradu oslobođenja Titograda „19. decembar" za 1976. godinu. Poslijediplomske studije sam upisala 1981. godine na Tehnološko-metalurškom fakultetu Univerziteta u Beogradu. U predviđenom roku sam položila sve ispite sa prosječnom ocjenom 9.5. Magistrirala sam januara 1993. godine sa temom „Fazni sastav i osobine vatrootpornih legura aluminijuma". Marta 1999. godine odbranila sam doktorsku disertaciju „Uticaj cirkonijuma i lantanida na strukturu i osobine kovačkih legura aluminijuma za rad na povišenim temperaturama".

Stalni radni odnos zasnovala sam 01.08.1979. godine u KAP-u - Fabrika za preradu aluminijuma, a od 01.06.1980. godine radim na Metalurško-tehnološkom fakultetu u Podgorici. kada sam izabrana u zvanje asistenta pripravnika, a zatim asistenta na Katedri za Fizičku metalurgiju. Izvodila sam vježbe iz predmeta: *Fizička metalurgija, Metalografija* i *Termička obrada.* Takođe, za studente Mašinskog fakulteta, izvodila sam računske i laboratorijske vježbe na predmetu *Mašinski materijali.* Nakon izbora u zvanje docenta na Metalurško-tehnološkom fakultetu Univerziteta Crne Gore, angažovana sam na izvođenju predavanja i vježbi na predmetima *Fizika čvrstoće i plastičnosti i Kristalografija.* U zvanje vanrednog profesora, za predmete: *Fizika črstoće i plastičnosti* i *Kristalografija* izabrana sam 13.04.2007. godine. U zvanje redovnog profesora, za predmete: *Fizika črstoće i plastičnosti* i *Kristalografija* izabrana sam 28.06.2012. godine. Kao redovni profesor angažovana sam na izvođenju nastave na Metalurško-tehnološkom fakultetu iz predmeta: *Fizika črstoće i plastičnosti, Termička obrada, Kristalografija, Izbor metala i legura, Inženjerstvo površina, Fizika materijala, Fizička metalurgija (odabrana poglavlja), Elementi difrakcije X-zraka, Kristalografija i difrakcija, Izbor inženjerskih materijala i Mehanizmi ojačavanja i dizajn materijala.*

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