

Kratek opis usposabljanja mladega raziskovalca (*Short description of the Young Researcher's training*)

1. Raziskovalna organizacija (*Research organisation*):

Univerza v Ljubljani, Fakulteta za kemijo in kemijsko tehnologijo

2. Ime, priimek in elektronski naslov mentorja (*Mentor's name, surname and email*):

Jurij Reščič jurij.rescic@fkkt.uni-lj.si

3. Šifra in naziv raziskovalnega področja (*Research field*):

1.04 Kemija

4. Kratek opis usposabljanja mladega raziskovalca (*Short description of the Young Researcher's training*):

Navedite tudi morebitne druge zahteve, vezane na usposabljanje mladega raziskovalca (npr. znanje tujih jezikov, izkušnje z laboratorijskim delom, potrebne licence za usposabljanje...).

slo:

Usposabljanje mladega raziskovalca bo potekalo po bolonjskem študijskem programu 3. stopnje »Kemijske znanosti« na Fakulteti za kemijo in kemijsko tehnologijo Univerze v Ljubljani (FKKT UL), ki vključuje obvezne in izbirne predmete, raziskovalno delo in izdelavo doktorske disertacije.

Tematika raziskovalnega dela spada na področje fizikalne kemije koloidnih sistemov in bo obsegala preučevanje interakcij nabitih nanodelcev (npr. TiO_2) z naravnimi in sintetičnimi polielektroliti v vodnih raztopinah oziroma suspenzijah. Nabiti nanodelci se uporabljajo v številnih aplikacijah, kot npr. v biomedicini ter kot adsorbenti za težke kovine. Na interakcije nabitih nanodelcev s polielektroliti vpliva sestava raztopine (pH, vrsta in koncentracija soli, prisotnost makromolekul) ter lastnosti samih nanodelcev, kot so njihov naboj, velikost in oblika. Razumevanje interakcij nabitih nanodelcev z drugimi v raztopini prisotnimi zvrstmi je ključno za razvoj učinkovitih aplikacij.

Pri raziskovalnem delu bo kandidat uporabljal nekatere eksperimentalne metode, ki se uporabljajo pri proučevanju koloidnih sistemov, med katere spadajo npr. statično (SLS) in dinamično (DLS) sipanje vidne svetlobe ter ozkokotno sipanje rentgenske svetlobe (SAXS), ki dajejo vpogled v strukturo raztopine, ter titracije in meritve zeta potenciala kot metode za določitev naboja nanodelcev. Teoretične osnove posameznih eksperimentalnih tehnik bo kandidat spoznal pri ustreznih izbirnih predmetih.

Eksperimentalna opažanja bo skušal razložiti z rezultati računalniških simulacij Monte Carlo (MC) in/ali molekulske dinamike (MD) za različne modelne sisteme, ki se bodo razlikovali v kompleksnosti.

Kandidat za mladega raziskovalca mora izpolnjevati pogoje za vpis na doktorski študijski program Kemijske znanosti na FKKT UL. Kandidat mora aktivno obvladati angleški jezik. Pri

izbiri bodo imeli prednost kandidati z izkazanim predznanjem fizikalne kemije, izkušnjami za delo v kemijskem laboratoriju in poznavanjem osnov programiranja ter računalniških simulacij.

eng:

Young researcher training will be conducted according to the 3rd Cycle (Doctoral) Study Programme in Chemical Sciences on Faculty of Chemistry and Chemical Technology, University of Ljubljana (FKKT UL), which includes compulsory and elective subjects, research work, and preparation of doctoral thesis.

The topic of the research work belongs to the field of physical chemistry of colloidal systems and will include the study of the interactions of charged nanoparticles (e.g. TiO₂) with natural and synthetic polyelectrolytes in aqueous solutions or suspensions. Charged nanoparticles are used in many applications, for example in biomedicine and as adsorbents for heavy metals. The interactions of charged nanoparticles with polyelectrolytes are influenced by the composition of the solution (pH, salt type and its concentration, presence of macromolecules) and by the properties of the nanoparticles themselves, such as their charge, size and shape. Understanding the interactions of charged nanoparticles with other species present in solution is key to developing effective applications.

In the research work, the candidate will use some experimental methods used in the study of colloidal systems, which among the others include static (SLS) and dynamic (DLS) visible light scattering, the small angle X-ray scattering, which all provide insight into the structure of the solution; titrations and the measurement of the zeta potential as methods to determine the charge of nanoparticles. The theoretical background of individual experimental techniques will be provided to the candidate during the relevant elective courses.

The candidate will try to explain the experimental observations with the results of computer simulations of Monte Carlo (MC) and / or molecular dynamics (MD) for different model systems, which will differ in complexity.

The candidate for a young researcher must meet the conditions for enrollment in the doctoral study program in Chemical Sciences at FKKT UL. The candidate must be proficient in English. Preference will be given to candidates with proven knowledge of physical chemistry, experience working in a chemical laboratory and are familiar with the basics of programming and computer simulations.