NATIONAL INSTITUTE OF CHEMISTRY

Slovenia is a small country at the Adriatic see and at the sunny side of the Alps. Ljubljana is its capital and in the centre is positioned The National Institute of Chemistry, which employs over 250 researches, has applied for 35 patents in last 5 years and is running 13 Horizon 2020 funded projects.

NATIONAL INSTITUTE OF CHEMISTRY, LJUBLJANA, SLOVENIA

MARIE SKLODOWSKA CURIE INDIVIDUAL FELLOWSHIP CALL UNDER HORIZON 2020

The National Institute of Chemistry Slovenia is seeking to develop a joint funding proposals with experienced, post PhD researchers, for submission under the Marie Sklodowska Curie Individual Fellowship (MSCA IF). The applicants must, at the deadline of submission which is **12th of September 2018**, have a doctoral degree or have at least four years of full time equivalent research experience.

If you are interested in the themes outlined below, please submit an Expression of interest

(CV and short description of your research area) to mail project.office@ki.si

It must also be stressed that Slovenia has established the complementary funding sheme for execution of proposals gaining the Seal of Excellence (reaching score of over 85 %).

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Proposed research topics:

1. ***Designed bionanostructures (protein origami)***
2. ***Cancer immunotherapy***
3. ***Synthetic biology of mammalian cells – design of signaling pathways***

Supervisor: prof. dr. Roman Jerala

4. ***Visible light assisted photocatalysis for water treatment***

Materials used as photocatalysts in the process of heterogeneous photocatalytic oxidation must be significantly improved in order to make this process economically attractive. In this respect, novel nanostructured and nanoshaped photocatalysts (including nanoplasmonic solids) will be developed that will allow efficient harvesting of visible light spectrum. The developed materials should have appropriate morphological, optical and electronic properties which will minimize charge recombination, and on the other hand maximize oxidative destruction and mineralization of water dissolved organic pollutants.

Supervisor: prof. dr. Albin Pintar

5. ***Direct biogas to liquid fuel conversion***

Biogas (i.e. a mixture of methane and carbon dioxide) is produced by anaerobic dark fermentation of solid wastes and renewables. However, to ease its utilization it would be from the practical point of view of great significance to transform biogas to liquid fuels or liquid fuel additives, without the formation of intermediate synthesis gas. In this respect, multifunctional heterogeneous catalysts will be developed that will enable efficient and direct transformation of biogas to either dimethylether or methanol in a single reactor unit.

Supervisor: prof. dr. Albin Pintar

6. ***Catalytic Carbon Dioxide Activation and Conversion by Hydrogenation or Alkylation***

- developing the concept of the “Methanol Economy” on the chemical recycling of CO_2 to useful fuels
- utilizing the parallel reactor system with heated gas sampling system (w/ recycle option), automation to enable computer control, data logging and automatic conduction of experiments
- identifying the nature and role of each metal component in catalyst over CO_2 hydrogenation
- emerging of low temperature reactions which can achieve a 100 % selectivity to methanol, so that it can reduce the consumption of energy on the reactor and reduce production costs
- expanding and investigating the predominant reaction pathway to further mixed metal oxide catalysts

Supervisor: prof. dr. Blaž Likozar

7. ***Direct Catalytic Methane Activation and Conversion to Aromatics and Alkenes***

- methane utilization − one of the most important research targets in catalysis
- methane-to-propylene and methane-to-aromatics processes
- catalysts − CeO_2 nanocrystals, zeolites & others
- development of novel catalytic routes
- propylene − raw material for a wide variety of products

Supervisor: prof. dr. Blaž Likozar

8. Catalytic Cellulose, Hemicellulose and Lignin Conversion to Value-added Bio-based Chemicals

- advance technology development for bio-refining & biotechnological process exploitation of different (LC/marine) biomasses
- cellulose fraction conversion to sorbitol, adipic acid or levulinic acid
- hemicellulose-derived furfural upgrade towards bio-monomers
- micro-kinetic model development for lignin depolymerisation reactions
- gas solubility studies in complex biomass-derived compounds using high-pressure view cell

Supervisor: Dr. Miha Grilc

9. Electrocatalytic Carbon Dioxide Activation and Reduction, Electrolysis and Fuel Cells

- miniaturized PEM FC system (membrane electrode assembly (MEA) of c. 1 cm2)
- in-depth microscopy durability studies and method development
- new electrochemical processes for platinum-group metals (PGM) recycling
- in-situ electrochemical transmission electron microscopy (TEM)
- CO_2 reduction in water and organic solvents (CO, methanol and ethylene)

Supervisor: dr. Nejc Hodnik

10. Pharmaceutical Process Engineering and Design for Small Molecules and Biosimilars

- translation of mechanistic multi-scale modelling to various unit operations and active pharmaceutical ingredients (API)
- continuous process design and optimization (predominantly for crystallizations and different chromatographic processes)
- miniaturization (i.e. plant-on-a-chip) and parallelization (i.e. numbering-up instead of conventional scale-up)
- disposable and single-use equipment application, as well as its optimization, where benefits would arose
- development of in-house software packages by compiling the existing mechanistic process modelling codes

Supervisor: dr. Uroš Novak

11. Synthesis and advanced electrochemical characterisation of low-cost and sustainable electrocatalysts for Fuel Cells/Electrolysers

Supervisor: prof. dr. Miran Gaberšček

12. Possible topics for joint research are also in connection with keywords below:

spectrally selective paint coatings, high solar absorptivity coatings, cool coatings, flame retardants, electrochromic devices, dye synthesized solar cells, thermochromics coatings, ionic liquids, anticorrosion coatings, pigments surface modification, hydrophobic surfaces, oleophobic surfaces, electrolytes, antifouling coatings, self-healing coatings

Supervisor: prof. dr. Ivan Jerman

13. Structural and functional studies of proteins involved in pathogenesis of intracellular bacteria (e.g. Listeria monocytogenesis)

14. Membrane interactions and mechanism of action of pore forming toxins from all kingdoms of life

15. Studies of interactions between proteins and membranes at the structural and functional level

16. Evolution of small tightly folded binding modules and ligand binding sites

17. Synthetic biology of nanopores

18. Structural and functional studies of plant viruses

Supervisor: prof. dr. Gregor Anderluh and dr. Marjetka Podobnik

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19. Development and application of solid-state NMR methods for the investigations of formation, for structure determination and for in-situ studies of the performance of porous catalysts and adsorbents.

(Expertise required by the applicant: basic programming skills (e.g. C, Matlab or similar; familiarity with Linux is an advantage).

Supervisor: prof. dr. Gregor Mali

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20. Development of nanoporous materials for heat storage/transformation applications, including design of new porous solids and post-synthesis modification of sorbents

tailoring of hydrophilic properties of inorganic and metal-organic sorption materials.

Expertise required by the applicant: Laboratory synthesis skills, Understanding/use of characterisation methods (XRD, TG/DSC, SEM, gas sorption).

Supervisor: prof. dr. Nataša Zabukovec Logar and dr. Alenka Ristić

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21. Development of nanoporous materials for carbon capture and utilization (CCSU) technologies

providing more compact configurations (composite materials, porous monoliths, etc.) to improve the energy and production costs in gas separation and conversion.

Expertise required by the applicant: Laboratory synthesis skills, Understanding/use of characterisation methods (XRD, TG/DSC, SEM, gas sorption)

Supervisor: prof.dr. Nataša Zabukovec Logar and dr. Matjaž Mazaj

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22. Development of multimetal functionalized porous materials for catalytic air and water purification

(metals on porous supports, metals on mixed oxides photocatalyst TiO_2/SiO_2, double layered hydroxides on porous supports)

Expertise required by the applicant: Laboratory synthesis skills, Understanding/use of characterisation methods (XRD, TG/DSC, SEM, gas sorption).

Supervisor: prof. dr. Nataša Novak Tušar

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23. Artificial SEI on metal lithium

Li-ion batteries are most promising portable storage devices and their energy density can be further improved by replacement of negative electrode by metallic lithium. The latter needs to be protected if we want to avoid formation of dendrites and constant passivation. Protection layers can be based on polymers or alloys.

Supervisor: prof. dr. Robert Dominko

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24. The role of protein dynamics at the ligand-protein binding process

The aim of these studies is a site specific characterization of protein dynamic processes in ligand-protein complexes on a wide range time scale at atomic level using spectroscopic methods and molecular dynamics simulations. This is required for the proper understanding of ligand-protein binding mechanisms. In general, the anticipated results will

inspire future research of the poorly explored role of dynamics and molecular flexibility in biological processes and can have direct impact on the development of novel therapeutic agents.
Supervisor: prof. dr. Simona Golič Grdadolnik

25. Protein aggregation monitored by vibrational spectroscopy

Infrared, micro Raman, VCD, NMR and advanced theoretical methods will be used to study the structural phase transitions of poly-L-lysine and polyglutamate induced by temperature and/or by changing the pH. The stability of peptide structure and intermediates will be tested in the presence of various types of cosolvents. Acquired knowledge from model systems will be applied in the study of amyloidal aggregation of insulin, which is related to type I diabetes mellitu
Supervisor: prof. dr. Jože Grdadolnik

26. Computational characterization of structural dynamics underlying function in proteins

Molecular dynamics simulations and free energy calculations are powerful biophysical tools offering spatial and temporal resolutions that can effectively complement experimental methodologies in studying molecular basis of protein function:
- How hydration water assists protein function?
- How does water pass through membrane transporters (SGLT)?
Supervisor: prof. dr. Franci Merzel

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project.office@ki.si

More information about the institute is available on www.ki.si

More info about the call:

MSCA IF is a proposal applying for the financial mechanisms of the European Commission. The application must be developed jointly by the researcher and the supervisor. The cost covered for the period of working for MSCA IF project are around 4000,00 EUR living allowance (brutto), 600,00 EUR mobility allowance and 500,00 EUR family allowance per month.

If you apply with National Institute of Chemistry, Slovenia, you are eligible for the WIDENING panel.

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We are looking forward to your email☺