Joint, collaborative work between highly skilled scientists is a prerequisite for achieving high scientific goals, which may further lead to major scientific breakthroughs. The latter are pivotal in tackling major societal issues such as decarburization of energy, chemical and transportation sector, clean water, air, etc. Interdisciplinary research, development and characterization of hierarchically-structured functional materials with an emphasis of applying solid theoretical knowledge of the relationship between structure down from macro to nanoscale and function in the relevant operational environment is a ubiquitous way to reach the mentioned goals.

At Jožef Stefan Institute (Ljubljana, Slovenia) we’d like to attract eligible experienced researchers with doctoral degree (chemistry, chemical engineering, materials science, physics or similar) at their early research careers committed for joint application of proposal for Marie-Curie Individual Fellowship (deadline 9.9.2020). Positions within the Department for Materials Synthesis (K-8) or Department for Nanostructured Materials (K-7) are offered depending with which department the subject of the proposal will be better aligned. Despite being formally employed at specific department the work of the post-doc will be jointly coordinated by Asst. Prof. Sašo Gyergyek (K-8) and Asst. Prof. Andraž Kocjan (K-7). The post-doc will thus be working within the field of expertise of supervisors to maximise the scientific outcome, but will be fostered among staff and facilities of both departments and beyond.

Call for candidates for applying to the Marie-Curie Individual Fellowships (MSCA IF) conducted at Jožef Stefan Institute

The MSCA IF aims to equip researchers with the necessary skills and international experience for a successful career, either in the public or the private sector. The programme responds to the challenges sometimes faced by researchers, offering them attractive working conditions and the opportunity to move between academic and other settings.

Individual Fellowships proposals are judged on their research quality, the researcher’s future career prospects, and the support offered by the host organisation. Fellows can also spend part of the fellowship elsewhere in Europe if this would boost impact, and those restarting their career in Europe benefit from special eligibility conditions.

Who can apply?
Prior to the call deadline (9 September 2020), the researcher (fellow) should have a doctoral degree or at least four years’ full-time research experience.

More information at:
https://ec.europa.eu/research/mariecurieactions/actions/individual-fellowships_en

Expression of interest deadline:
15 June 2020

Candidate selection:
20 June 2020

MSCA application deadline:
9 September 2020
Possible subject for the proposal

Below is the very short description of possible subject for the proposal. We will fully collaborate with the applicant during proposal writing and will provide all the necessary help and encouragement. Both supervisors strongly believe in application inspired research and would prefer that the proposal is in line with that. All the proposed topics have in common application of the phenomenon that the magnetic nanoparticles rapidly heat when exposed to an external AC-magnetic field. Incorporation of magnetic nanoparticles in catalytic nanocomposites enables electrification of chemical conversions, may improve selectivity, reduce costs for downstream processing and most importantly is relatively new, unexplored strategy in chemical sciences. The list of topics is suggestive and further development is expected to be applicant’s contribution.

a) Development of surface Frustrated Lewis pairs for AC-driven hydrogenation. Frustrated Lewis pair are constructions made of Lewis acid and Base that due to steric hindrance cannot form an adduct. The so formed electrostatic cavity (bounded by lone electron pair and electron acceptor atom/ion) can dissociate H₂ into active species that can hydrogenate a substrate. Some molecular examples can be found in literature however solid examples are much rarer. Oxygen vacancies or adsorbed molecular Lewis bases onto solid oxide surface can as well behave as Frustrated Lewis pairs and represent an alternative heterogeneous catalyst to noble metals.

b) Reduction of noble metals in heterogeneous catalysts. Many relevant chemical transformations are efficiently catalysed by rare noble metals such as ruthenium, palladium, rhenium, etc. Due to their price and limited availability their industrial application is very limited. A possible solution application of single-atom or “nearly” single atom catalysts. Single atoms of noble metal can be dispersed on strongly bounding solid surface such as N doped carbons, graphitic carbo nitride or surface cationic vaccines in oxides. Another approach alloying noble metal with less noble one or formation of a thin shell of noble metal on less noble metal nanoparticle.

c) Additive manufacturing of catalyst structures with designed porosity. Research and development of feedstocks and techniques for the additive manufacturing (AM) of ceramic-based porous structures enabling heterogeneous catalysis. The aim is to integrate the microchannel-like catalyst design and composite ceramic-catalyst materials to form components with superior catalytic functionality. Immobilising the active catalyst species (based on the synthesized nanoparticulated composite materials developed in the above-mentioned points) is invaluable to heterogeneous catalysis and, therefore, to many chemical processes. However, the solid inactive framework should provide chemical, thermal and/or mechanical stabilisation of the catalyst species.
Asst. Prof. Sašo Gyergyek is a scientific collaborator at the Department for Materials Synthesis JSI and lecturer at Faculty of Chemistry and Chemical Engineering University of Maribor. In years 2013-2014 he spent one school year as post doc researcher at École Polytechnique Fédérale de Lausanne, Switzerland where he worked with Prof Heinrich Hofmann, a renowned expert in the field of biomedical applications of nanoparticles. His research interests are in characterization and assembling of nanoparticles into functional materials such as nanocomposites and catalysts. His main research focus lays in exploiting AC-field driven heating of magnetic nanoparticles in catalysis. He uses bottom-up approaches for preparation of catalytic materials composed of magnetic nanoparticles embedded within carbon or alumina matrix decorated with catalytic nanoparticles. Such catalysts were successfully employed in AC-field-driven hydrogenation/deoxygenations of biobased platform chemicals to value-added chemicals in slurry type reactors. He is extensively collaborating with Department for catalysis and chemical engineering of National Institute of Chemistry (Slovenia). He is also collaborating with researchers from University of Southern Denmark, University of Bern, University of Burgundy, etc.

Asst. Prof. Andraž Kocjan is a senior research fellow at Department for Nanostructured Materials and a leader of a research programme group Ceramics and complementary materials for advanced engineering and biomedical applications with the focus on developing ceramic materials with novel or improved functions for demanded applications though exploring the potentials of advanced processes. In 2011-2013 he was on postdoctoral stay as a guest researcher at the Division of Materials and Environmental Chemistry, Arrhenius Laboratory, Stockholm University, Sweden. There, he established important contacts with Prof. Zhijian Shen and Prof. Lennart Bergstrom, where he also gained crucial experience in processing science and technology. Up to date, Dr. Kocjan has an EU and Slovenian patent, GB patent application, technical invention, has published 44 scientific papers (~1000 citations), 2 professional papers and 3 non-technical articles and held 7 invited talks and 7 interviews. He has co-founded a spin-out company based on JSI’s licensed knowledge producing bioactive fillers for endodontic treatment of teeth. He is responsible for the 3D printing of various materials at the JSI.
Available infrastructure

JSI’s departmental labs are fully equipped for nanoparticle synthesis and materials processing (autoclaves, freeze driers, 3D printers, furnaces with controlled atmosphere, three-roller mills, extruder, cold isostatic press, etc.) and for state-of-the-art characterisation (laser scattering, zeta meters, Hg-porosimetry, nitrogen adsorption/desorption, rheometer, hot disk, optical dilatometer, universal mechanical testing device equipped with fatigue testing, VSM, SQUID, AFM coupled RAMAN, FTIR, TG-DTA, XRD, etc). All departments have an access to the Centre for electron microscopy and microanalysis (CEMM), an infrastructure unit of the JSI, which combines the analytical equipment in the field of electron microscopy and micro-analysis (FEG-SEM, FIB-SEM, TEM, AR-STEM, AFM).

The Jožef Stefan Institute (JSI), named after the distinguished 19th-century physicist Jožef Stefan, is the leading Slovenian research organization. It is responsible for a broad spectrum of basic and applied research in the fields of natural sciences and technology. The staffs of around 960 specialize in research in physics, chemistry and biochemistry, electronics and information science, nuclear technology, energy utilization and environmental science. The Institute was founded in 1949 initially established as an Institute of Physics within the Slovenian Academy of Sciences and Arts, is today involved in a wide variety of fields of both scientific and economic interest. After close to 60 years of scientific achievement, the Institute has become part of the image of Slovenia.

And for the end some facts about Slovenia. Slovenia is mostly characterized by its small area situated in an extremely diverse geographical area. The East West line is stretching from flatlands through hilly centre reaching Adriatic Sea at its South west corner. The most of the North is Alpine region and South is characterized by hilly vineyards and vast forests. Ljubljana being situated in the middle is a great point to visit all the interesting parts and is in itself an interesting, typical middle European town. MSCA Fellowship offers a very competitive salary, enabling a high standard of leaving in one of the nicest capitals in Europe.

Applicant should respond to the call to:
Sašo Gyergyek saso.gyergyek@ijs.si
or
Andraž Kocjan a.kocjan@ijs.si