

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA20126

Grantee name: Josep Ferré i Borrull

Details of the STSM

Title: Participation as Lecturer at the Summer School on Porous Materials at UC San Diego and Prospective Contacts with Faculty Members

Start and end date: 29/07/2022 to 9/08/2022

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

Attendance to the conference by Professor Zheng Cheng of the UCSD. Professors Cheng Group focuses on the design of all-solid-state batteries with a special view to their recycling or regeneration. One of the main challenges of the battery field nowadays is its low recycling levels which can cause severe environmental issues in the future. The research developed by Prof. Chen develops designs and procedures to produce batteries that can be safely disassembled, their components can be solution processed, separated and regenerated with environmentally-friendly processes and low energy consumption. These goals will permit better adoption by industries and better usage of the battery materials.

Visit to Professor Jonathan Pokorski, leader of the group IRG2 focused on Engineered Living Materials. This group works on developing methods to integrate engineered living matter with polymeric materials, what is called materials at the living/non-living interface. One of the interests is on protein:polymer conjugates. Proteins are very good for receptor binding for drug delivery or activation of signaling cascades, but at the same time they are difficult to fully incorporate into soft materials. Prof. Pokorski group works on the synthesis of novel protein:polymer conjugates to address these problems chemically. With this, achievements such as slow-release protein/polymer depot formulations have been reached. Scalability is also a fundamental goal to permit to distribute vaccine devices in resource poor areas, avoid cold chain distribution and improve delivery into the body.

Visit with Professor Tod Pascal, Leader of the RG1 of the MRSEC devoted to the field of Predictive Assembly. The different research lines intend to study the assembly of nanoscale building blocks into

¹This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

functional, tunable materials that operate at the meso- to macroscales. Their approach is double: coupling experimental and computational tools. This permits a much better understanding of the materials aim for broad impact in energy security, environmental sustainability, human health, and civil infrastructure. The lines focus on polymer-grafted nanocrystals and natural and synthetic proteins and the groups seek both to explain the self-assembly properties of such materials and to provide design tools that permit tailoring a material for specified functions.

Lecture at the Research Immersion in Materials Science and Engineering Summer School of the UCSD. The lecture concentrated on the technologies of Porous Anodic Alumina, with special focus on the details of the oxide formation and growth and how such details permit to design strategies to engineering the nanostructure, obtaining distinctive optical properties and find applications. Interaction with the summer school students was active and fruitful.

Interview with Yves Therault, Program Manager for Education and Outreach Programs at the UC San Diego-based Qualcomm Institute. He is extremely active in the Outreach Activities of MRSEC to K-12 schools. Tries to promote Nanotechnology in general, and applications of porous materials in particular to young researchers to wake interest in the young people for Science. He offers his expertise in Outreach to help the NETPORE Action to start its own activities.

Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

From the visit to Professor Pokorski it has been concluded that Nanoporous Anodic Alumina, a material focus of research for several groups within the NETPORE Action can be used as a possible mold for the extrusion processes the group of Professor Pokorski investigates. We reach the agreement to interchange information about the material and the processes to explore possible collaborations. Another point of common interest is the possibility of using macroporous silicon needle arrays. Prof. Pokorski group has tried to fabricate nanoneedle arrays from polymer for the gradual subskin delivery of the vaccine:polymer composites without success. Macroporous silicon needle arrays can offer a solution to this problem.

Professor Tod Pascal group is very open to all kind of collaborations. We agreed in maintaining contact and exploring common interests and complementary ideas. He comes often to Europe and can make a Seminar In person at some of the NETPORE related conferences or at the NETPORE seminars. Professor's Pascal group is aiming at setting up an open framework that can provide online modeling tools to researchers. This is thought as an entry point for new researchers in the field to start their activities in modeling and prediction of complex systems as well as possible way to start sharing ideas and make collaborations.

The awareness of the NETPORE action has been extended to the trainees at the RIMSE Summer School. The class given by the Grantee was also followed by different Faculty of the MRSEC institute at UCSD so possible new incorporation to the Working Groups of NETPORE can be envisioned.

The interview with Dr. Yves Therault was especially fruitful. He is an expert in outreach activities and offers his collaboration to NETPORE to develop ideas that can be brought into reality within the framework of the Action. He is leading many different programs related with Nanotechnology and intended for K-12 and Community College levels. He proposes activities such as learning projects about one subject (i.e.:color) and introducing the nanotechnology concepts (quantum dot fluorescence, structured and photonic crystal color, etc.). Other activities comprise projects showing the concept of

hydrophobicity and hydrophilicity on the basis of natural objects (such as plant leaves) and introducing the artificial nanotechnology-based facts about such subject. The RIMSE Summer School is also an Outreach Project in itself. By contacting State educational authorities, several High-School teachers are enrolled in the program and are following the lectures with a view to translate the learnings into educational projects at their Home institutions. This is a proposal that could be followed by the NETPORE Action Outreach responsables. Dr. Therault is open to discuss Outreach Proposal, both for NETPORE and in collaboration and to talk with NETPORE responsables via zoom meetings.