SADIK COGAL

Polymer Institute
Slovak Academy of Sciences

Project number
1252/02/02

Project duration
7/2022 - 12/2023

"SASPRO 2 Fellowship is a great opportunity for me to visit the Polymer Institute of SAS as a host institution and work with collaborators at the same department. This will allow me to extend my research activities on research interests, acquire new skills using in different research environment and improve the collaboration for future project ideas. My expectations from this programme are to publish high quality research results and to benefit from the long-term corporation with the host organization. "

SASPRO 2

BIOGRAPHY

Sadik Cogal received his MSc (2009) in Solar Energy Institute from Ege University (İzmir, Türkiye) and PhD (2014) in Chemistry from Suleyman Demirel University (Isparta, Türkiye) with topics focused on fabrication of materials for solar cells. He also visited the University of South Florida Chemical & Biomedical Engineering (USA) in 2018 with a TUBITAK fellowship for conducting postdoctoral research on two-dimensional transition metal dichalcogenide based materials for electrocatalytic applications. Sadik Cogal is currently a postdoctoral researcher at the Polymer Institute of the Slovak Academy of Sciences through the SASPRO2 programme. He serves as an associate professor at his home institution at the Chemistry Department of Burdur Mehmet Akif Ersoy University in Türkiye. Sadik Cogal's research focuses on the synthesis of conducting polymers and their composites for electrochemical applications such as sensors, solar cells, and fuel cells. He has recently been working on the two-dimensional transition metal dichalcogenides-based conducting polymer nanocomposites for electrochemical water splitting process, which is a highly important research field for sustainable energy production.

PROJECT SUMMARY

Design of efficient electrocatalysts for water splitting based on metal doped 2-dimensional transition metal dichalcogenides/ conducting polymer hybrids

The overall water splitting process is a promising technology in the production of sustainable and clean energy. It is of great importance to develop highly efficient and cost-effective catalysts to obtain high performance in this process. Hydrogen evolution (HER) and oxygen evolution (OER) reactions are the two half reactions in electrocatalytic water splitting. Generally, Pt- and Ir/Ru- based materials are the most efficient catalysts applied in HER and OER, respectively. However, Pt, Ir and Ru are rare metals and expensive, thus they are not suitable for large-scale applications. Therefore, one challenge that needs to be overcome is to develop novel catalysts, which have bifunctional active sites for both OER and HER. Among different materials, transition metal dichalcogenides (TMDs) can be formed in single- and multi-layer and exhibit diverse electronic properties and promising electrocatalytic active sites for water electrocatalysis. On the other hand, conducting polymers (CPs) with π conjugated systems possess unique properties and were used as conductive substrates in preparation of electrocatalysts. Recently, the combination of CPs with TMDs has attracted much attention not only for understanding their fundamental properties but also for various applications. Furthermore, transition metal doping in these nanostructures will lead to further improvement in their electrocatalytic properties. In this project, TMD ($MoSe_2$ and WSe_2)/CP nanostructures will be prepared in the presence of CPs as a template using hydrothermal method and simultaneously will be doped with small amount non-noble metals (Co, Ni and Fe) to induce various functionalities to TMDs. The proposed bifunctional electrocatalysts and the systematic works based on metal doping have not been studied before and display the novelty of this project. Therefore, the successful completion of this project will have a significant impact on academic research and industrial application.

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PUBLICATIONS

1. Sadik Cogal, Swetha Ramani, Venkat R Bhethanabotla, John Kuhn. Unravelling the Origin of Enhanced Electrochemical Performance in CoSe2-MoSe2 Interfaces. ChemCatChem, 13 (8) (2021) 2017-2024.
https://doi.org/10.1002/cctc.202001844

2. Swetha Ramani, Sadik Cogal, Jeffrey Lowe, Venkat R Bhethanabotla, John Kuhn. Hybrid Co@Ni12P5/PPy microspheres with dual synergies for high performance oxygen evolution. Journal of Catalysis, 391 (2020) 357-365.
https://doi.org/10.1016/j.jcat.2020.08.035

3. Sadik Cogal, Venkat R. Bhethanabotla. Electrochemical sensor based on carbon incorporated WSe2 nanosheets for simultaneous detection of ascorbic acid, dopamine and uric acid. IEEE Sensors Journal, 22 (15) (2022) 14952-14958.
https://doi.org/10.1109/JSEN.2022.3184509

For full publications: https://www.webofscience.com/wos/author/rid/A-3337-2017 or https://www.researchgate.net/profile/Sadik-Cogal

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