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Ram K Gupta

Pittsburg State University, USA

Improved 2-dimensional materials for hydrogen evolution reactions

Hydrogen production from water electrolysis is one of the greenest ways to generate fuel for commercial applications. Commercial application of water electrolysis requires low cost, high performance and stable electrocatalysts which can operate at low overpotential. The current state-of-the-art noble metal-based electrocatalysts such as platinum are the most efficient electrocatalysts for water electrolysis; however, their high cost and limited availability have curtailed their extensive use as electrocatalysts. In this research, we have synthesized a catalyst using a cost-effective method for water electrolysis. The 2-dimensional catalyst was synthesized using earth abounding elements and its electrocatalytic activities were improved by one step facile chemical treatment. Core-shell nanostructured 2-dimensional molybdenum sulfide was synthesized using chemical vapor deposition method and was treated with hydrazine to improve its catalytic activities. Hydrazine treated catalyst showed significant improvement in the electrocatalytic performance. They showed about 100mV improvement in overpotential after exposure to dilute hydrazine at room temperature with a significant change in Tafel slope. Mechanism of such improvement in the catalytic properties will be discussed in detail. Our studies suggest that simple chemical treatment process can be adopted to improve catalytic properties of 2-dimensional material which was derived from earth abundant elements for industrial production of hydrogen as a fuel.

Biography

Ram K Gupta is an Assistant Professor of Chemistry at Pittsburg State University. His research focuses on green energy production and storage using conducting polymers, composites, nanomaterials and utilizing bio-based polymers for commercial applications. He has published over 160 peer-reviewed journal articles, made over 150 national/international/regional presentations, chaired many sessions at national/international meetings, and received over 1 million dollars for research and educational activities from external agencies NSF, DoE. He is serving as Associate Editor and Editorial Board Member for various journals. He is also serving as Keynote Speaker and Organizing Committee Member for Industrial Chemistry international conference.

ramguptamsu@gmail.com

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