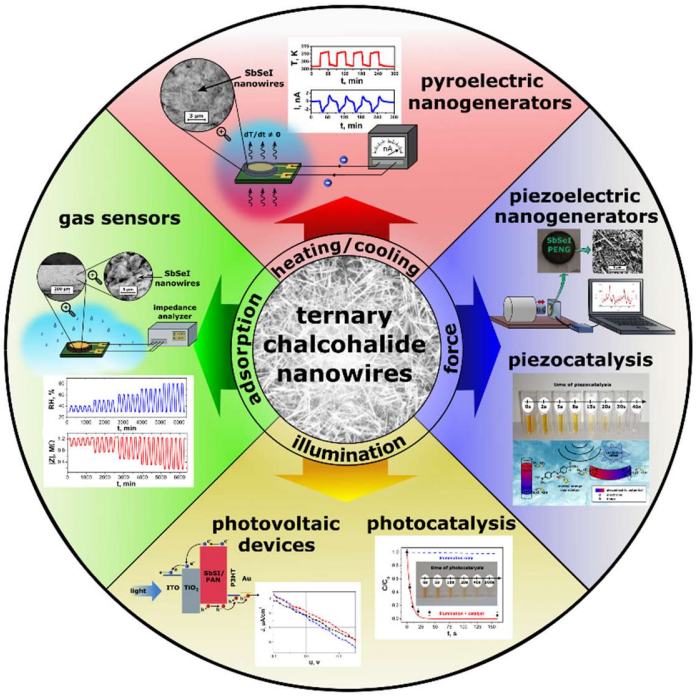
Chalcohalide Nanomaterials for Energy Conversion and Sensors

Abstract

The chalcohalide nanomaterials exhibit numerous interesting characteristics, including ferroelectric, piezoelectric, pyroelectric, electrocaloric, photovoltaic, photoelectrochemical, photocatalytic, and piezocatalytic properties. Many chalcohalide semiconductors are recognized as photoferroelectrics since they possess both photoactive and ferroelectric properties.

This lecture provides an overview of fabrication of chalcohalide nanomaterials using different methods. The strategies of the chalcohalide nanomaterials processing for construction of functional devices are also presented. The potential applications of the chalcohalide nanomaterials for mechanical/thermal energy harvesting and energy storage are discussed. The special attention is paid to the piezoelectric, pyroelectric, and triboelectric nanogenerators. Use of antimony and bismuth chalcohalide nanomaterial for solar energy scavenging and light detection is revieved. The gas sensing properties of the chalcohalide nanomaterials are presented. This lecture also describes the photo- and piezocatalytic degradation of organic pollutants using antimony chalcohalides, bismuth chalcohalides, and heterostructured materials as catalysts. Finally, the major challenges as well as emerging trends in preparation and future applications of the chalcohalide nanostructures are proposed.



Speaker Bio

Krystian Mistewicz received MSc in physics with honors at the Mathematics and Physics Faculty at the Silesian University of Technology (Gliwice, Poland) in 2010, and Ph.D. in physics with distinction from the University of Silesia (Katowice, Poland) in 2015. He is currently an assistant professor at Institute of Physics at the Silesian University of Technology. He was a visiting research scholar at the University of Wisconsin-Madison (USA). In 2021, Krystian Mistewicz received IAAM Young Scientist Medal from International Association of Advanced Materials (Sweden). His research interests are focused on nanotechnology, sonochemistry, ferroelectric nanomaterials for gas sensors, photovoltaic devices, pyroelectric and piezoelectric generators.