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SPEAKER SERIES

PRESENTS

3-D network of edge-enriched MoS_2 flakes for next generation room temperature and low power sensor applications

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E220, Engineering Building II

LECTURE ABSTRACT

Controlled and tunable growth of chemically active edge sites over inert basal planes in MoS_2 flakes is the key requirement to realize their vast number of application in catalytic activities like hydrogen evolution and sensor development. Here, we demonstrated controlled and tunable growth of MoS_2 flakes ranging from individual vertically aligned edged-oriented MoS_2 flakes to dense and electrically connected 3-D network of MoS_2 flakes using atmospheric chemical vapor deposition technique over the large area (1 cm^2). On the basis of the structural, morphological, and spectroscopic analysis reveals that the in-plane MoS_2 was found to work as a seed layer for the initial growth of edge-enriched and vertically aligned MoS_2 flakes that finally leads to the growth of an interconnected 3-D network of edge-enriched MoS_2 flakes. Finally, the gas sensor was fabricated and the performance was tested for H_2 and NO_2. The preferential adsorption of different gases on the different active sites of MoS_2 was observed to provide the tunability and selectivity. The device of selective MoS_2 flakes shows fast response and recovers even at room temperature for H_2 and NO_2 gases. This study provides a strong experimental evidence for the role of MoS_2 edge-sites in the fast hydrogen sensing and a step closer towards room temperature, low power H_2, and NO_2 sensor development.

At the end of my talk, I will also share some recent development in the direction of the solar-blind photodetector.

References

[1] A. V. Agrawal et al. ACS Applied NanoMaterials 2018, 1, 2356.
[2] A. V. Agrawal, et al. ACS Sensor 2018, 3, 998.
[3] A. V. Agrawal et al. Applied Physics Letters, 2017, 111, 093102.
[4] K. Arora et al. ACS Photonics (10.1021/acsphotonics.8b00174)

SPEAKER BIOSKETCH

Dr. Mukesh Kumar received his PhD from Indian Institute of Technology Delhi, India and was a postdoctoral fellow working at South Dakota State University and National Renewable Energy Laboratory from 2010 to 2013 for the nanoscale charge transport of organic solar cells and development of reliable and flexible thin films for next generation flexible optoelectronic devices. Before joining at IIT Ropar, Dr. Kumar was working for Hysitron Inc., USA. Recently he received young scientist research award from Department of Atomic Energy, India and Bhaskara Advanced Solar Energy Fellowship under Indo-US Science and Technology Forum (IUSSTF). Currently, he is visiting at Rice University for summer.

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