Innovative Energy & Research
ISSN: 2576-1463
2021
Vol.10 No.1

Understanding the structure-property tunability of large area sputtered vertically aligned edge-enriched MoS2 sheets for supercapacitor energy storage application

Pranjala Tiwari, Jyoti Jaiswal and Ramesh Chandra

Thin Film Laboratory, IIT Roorkee, India

Abstract

Insights into the fundamentals of structure-property relations is one of the most important key parameters, which can be utilized for tailoring numerous material properties such as electrical, optical, wettable and electrochemical for photonic, optoelectronic, energy storage and sensing devices. Herein, we report a controlled single-step, large area growth of highly crystalline MoS2 nanoflakes consisting of vertically grown edge exposed layers using DC magnetron sputtering technique. To understand a correlation between microstructural and material properties, we have been prepared the MoS2 of varying thickness (~1 nm – 440 nm). A number of standard characterization techniques such as XRD, XRR, FESEM, Raman spectroscopy, TEM, and XPS, which confirm the formation of vertically aligned nanocrystalline MoS2 films of different thicknesses. Surprisingly, the growth is readily achievable on a variety of insulating as well as conducting substrates and the growth mechanism is discussed in detail. Wettability results manifest that our films could be tuned by varying the layer number as well as the exposed edge sites. We have further made an attempt to augment our prevailing understanding on structure-property relations of MoS2 in order to provide large tunability in the electrical properties. The MoS2 electrical resistance was observed in the range of 15 kΩ – 98 MΩ and displayed an inverse relationship with the number of layers. Further, we have carried out the charge storage measurements and found the three-electrode cell capacitance to be 5.48 mF/cm2 at scan rate of 10 mV/s.

Biography:

Pranjala Tiwari is currently working as a full time research scholar in Institute Instrumentation Centre at Indian Institute of Technology Roorkee, India. Her area of expertise includes thin film fabrication and applications, energy storage devices, supercapacitors and nanomaterials. She has completed her M.Tech in Nanoscience and Technology from Delhi Technical University in the year 2016. Her doctoral research is focused on the synthesis of functional nanostructured thin films for energy storage and energy conversion applications. She completed her B.Tech, in Electronics and Communications from RGPV University, Madhya Pradesh in the year 2013.

Speaker Publications:

1. P. Tiwari, G. Malik, R. Chandra (2018), Phase-dependent structural and electrochemical properties of single crystalline MnS thin films deposited by DC reactive sputtering, J. of App. Physics, 124, 195106.
2. P. Tiwari, J. Jaiswal, R. Chandra (2019), Hierarchal growth of MoS2@CNT heterostructure for all solid state symmetric supercapacitor: Insights into the surface science and storage mechanism, Electrochemica Acta, 324, 134767.

23rd International Conference on Advanced Energy Materials and Research; Webinar- June 21-22, 2021.

Abstract Citation:

Pranjala Tiwari, Understanding the structure-property tunability of large area sputtered vertically aligned edge-enriched MoS2 sheets for supercapacitor energy storage application, Advanced Energy Materials 2020, 23rd International Conference on Advanced Energy Materials and Research; Webinar- June 21-22, 2021.

(https://energymaterials.materialsconferences.com/abstract/2020/understanding-the-structure-property-tunability-of-large-area-sputtered-vertically-aligned-edge-enriched-mos2-sheets-for-supercapacitor-energy-storage-application)