ABSTRACT **Index No.: 151/16/Phys./25**

Title: Development of novel synthesis routes and exploring application aspects of some transitional metal sulphide nanostructures.

Recently, metal sulphide nanomaterials have attracted great attention because of their excellent properties and promising applications in various fields including electronic, optical and optoelectronic devices. Although significant amount of work have already been performed there are lot of problems to be addressed. Development of facile synthesis routes, understanding their physical, structural and morphological properties are urgently needed for the utilization of such materials to their full potential.

This research will be directed towards the development of facile synthesis routes of some transitional metal sulphide nanostructures by traditional and also by some hybrid technique. Particularly efforts will be directed toward obtaining controlled synthesis of two-dimensional (2D) nanoform of such materials. Both materials in powder form and aligned nanostructures on substrates will be synthesized and investigated. Effect of deposition conditions on the structural, morphological, electrical and optical properties will be thoroughly investigated. The synthesized nanostructures will be characterized by advanced characterization techniques like Field emission scanning electron microscope (FESEM) for morphological characterizations, High resolution transmission electron microscope (HRTEM) and X-ray diffraction (XRD) for structural information, Energy dispersive analysis of X-rays (EDX) and X-ray photoelectron spectroscopic (XPS) studies for compositional and stoichiometric characterization etc. In detail, optical properties including band gap, luminescence and optical constants will be determined and thoroughly analyzed. Establishment of correlation between luminescence and band structures will be emphasized.

The optimized materials will be investigated to study the electron emission property for cold cathode applications. These semiconducting materials with small thickness and/or sharp nanoedges are expected to exhibit good field emission. Also, as some of these metal sulphides having band gaps in the visible region will also be investigated for photocatalytic properties addressing environmental issue. Efforts will be directed towards enhancing the photocatalytic properties by making nanocomposites and/or, noble metal with metal-sulphide superstructures. Efforts will also be given to explain all the results and build some physical models.

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