

International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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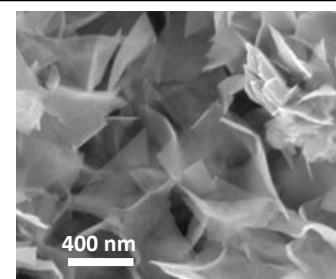
2D-Nanolayered Transition Metal Sulfides (2D-NTMS)

Overview

Two dimensional nanosheet-like structure in sulfides of transition metals (tungsten and molybdenum) have shown wide range of attractive properties, which can be harnessed for various applications such as catalyst or lubricant in petrochemical and automotive sectors, electrode material for Li-ion batteries and electrocatalyst for hydrogen evolution reaction (HER), etc. However, the absence of commercially viable routes for their synthesis in bulk quantity and reproducible quality has been a major issue hindering their commercial exploitation. Recently, a novel technique has been developed by ARCI to generate such 2D structure in WS_2 and MoS_2 . The process offers unique control capabilities to synthesize tailor-made 2D nanolayered structure in these sulfides in bulk amount. Based on the application and/or required properties, the size and thickness of these nanosheets can be altered by changing various process control parameters.

Key Features

- Synthesis of pure as well as mixed WS_2/MoS_2 nanosheet powders
- Synthesis of doped- WS_2/MoS_2 nanosheet powders
- Reasonably good oxidation resistance
- Feasibility to synthesize 2D-nanostructures of other transition metal sulphides
- Scalable process for bulk production



Microstructure of typical 2D- WS_2 nanosheets by ARCI method

Potential Applications

- Solid lubricant for aerospace and automotive sector
- Solid lubricant for forging and other manufacturing processes
- Additive to automobile Lub-oil
- Additive to grease for improved performance under high shear stress
- Petrochem catalyst
- Electrocatalyst for HER
- Li-ion battery electrode
- Self-lubricating composites and coatings (metallic/ceramics/polymer)
- Sensors and actuators



Nanosheet powder grades of WS_2 produced by ARCI method

Intellectual Property Development Indices (IPDI)

- Stability in air validated at laboratory scale
- Consistency of the powder grade tested
- Scale-up of reactor underway

Status	1	2	3	4	5	6	7	8	9	10
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Major Patents/Publications

1. J. Joardar and M.S. Sylvester, Indian Patent (Ap. No. 1703/DEL/2012).

Centre for Nanomaterials (CNAM)

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