Flakes Size-Dependent Optical and Electrochemical Properties of MoS2

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ABSTRACT:

Background: Molybdenum disulfide (MoS2) is a transition metal dichalcogenides and has some interesting and promising properties. MoS2 has direct and indirect band gaps depending on its crystalline structure. In addition, its sheets morphology makes it a good candidate for supercapacitor applications.

Objective: The aim of this work is to study the effect of MoS2 flakes size on its optical and electrochemical properties.

Method: MoS2 with different flakes sizes were prepared by exfoliation method. The exfoliation was performed by sonication of MoS2 powder in N,N-Dimethylformamide followed by different centrifugation speeds. UV-Vis spectra illustrated the optical energy gap was inversely proportional to the MoS2 flakes size.

Results: Absorption coefficient values indicated that the exfoliation reduced the number of layers. Symmetric supercapacitor was made from two MoS2 electrodes and tested in 6 M KOH electrolyte. The specific capacitance was found to be dramatically increased with decreasing flakes size (9.5 and 4.5 mF/cm2 for 0.26 and 0.98 μm flakes size, respectively).

Conclusion: These findings recommend that MoS2 can be the excellent electrode material for supercapacitor.

KEYWORDS: Molybdenum disulfide, nanoflakes, optical band gap, supercapacitors, cyclic voltammetry, Transition Metal Dichalcogenides (TMDs).