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Enhanced physical properties of two dimensional MoS₂/poly(vinyl alcohol) nanocomposites

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Abstract

Herein, we synthesized few-layered water dispersible two dimensional (2D) MoS₂ nanosheets using thiourea by a facile hydrothermal method. The MoS₂ nanosheets consisted of graphene-like structures that are 4 nm in thickness and ~ 2 μm in size as observed from AFM analysis. The incorporation of MoS₂ nanosheets into the poly(vinyl alcohol) (PVA) matrix significantly improved the thermal and dielectric properties of the fabricated nanocomposites (PVA-MoS₂). The nanocomposite films demonstrated tremendous enhancements of the tensile strength (56%), modulus (42%), and toughness (more than 300%) after incorporation of 2 wt% of MoS₂ nanosheets. The nanocomposite films also exhibited outstanding barrier towards hydrogen; specifically, the nanocomposite with 2 wt% of MoS₂ nanosheets exhibited a decrease of almost 94% in its permeability than the PVA film for hydrogen gas. Different theoretical models have been applied to investigate the nature of dispersion of MoS₂ inside the PVA matrix based on tensile modulus and permeability.

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