Abstract

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Exfoliation of MoS2 nanosheets by applying Nd:YAG laser irradiation at different laser energies and potential application in triblogy

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Abstract

A novel method was applied to exfoliate MoS2 nanosheets synthesized by using a hydrothermal method. The MoS2 nanosheets were irradiated using an Ng:YAG laser operating at 532 nm with a 5 ns pulse duration for 15 min with different energies 40, 60, and 80 mJ. To investigate the effects of laser energy on the absorption evaluation of MoS2 nanosheets, UV-Vis spectroscopy technique was applied and energy band gaps were calculated in the range of 4.3- 4.6 eV. The successful formation of a hexagonal structure for prepared MoS2 nanosheets was confirmed by XRD analysis. A decrease in the crystallite sizes of MoS2 nanosheets from 50 to 15 nm by an increase in laser energy was a result of XRD investigations. The TEM images of the MoS2 nanosheets were performed to investigate the structural deviations that occur after various laser irradiation energies. TEM results indicate that the final MoS2 nanosheets are few-layered possessing uniform size distribution. A slight red-shift and a blue-shift were observed in Raman spectra by an increase in laser energy from 40 up to 80 mJ. The laser energy-dependent tribological properties of MoS2 nanosheets were investigated. The enhancement was observed for the Zeta potential values by increasing the laser energy. The increasing of laser energy leads to the increment of the viscosity index. A reduction in friction coefficient occurred for the base oil containing MoS2 nanosheets additive when irradiated under 80 mJ laser energy. The results imply that laser irradiation can improve not only the hydraulic properties of MoS2 nanosheets but also the limits of the temperature of the fluid containing MoS2 nanosheets making them a promising candidate for industrial applications.

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Biography

Fahimeh Abrinaei has completed her PhD at the age of 29 years from Plasma Physics Research Center of Islamic Azad University. She is currently an Associate Professor at East Tehran Branch of Islamic Azad University. She has published more than 20 papers in reputed journals. Her fields of work include Laser materials processing, Materials science, Nonlinear optics, and Nanomaterials in tribology science.

