Femtosecond laser synthesis and fragmentation of molybdenum disulfide nanoparticles in liquid

Anton S. Chernikov, Dmitriy A. Kochuev, Ruslan V. Chkalov, Kirill S. Khorkov,
Vladimir State University, Vladimir, Russia

The paper shows the results of experiments with the processing of MoS2 samples, the study of the obtained solutions and their subsequent additional processing. As a result of the study, colloidal solutions of molybdenum dichalcogenides in ethanol, histograms of the size distribution of nanoparticles and optical transmission spectra were obtained.

The analysis of the obtained SEM images, as well as the study of a large number of articles, showed that the structure and external shape of molybdenum disulfide nanoparticles are very sensitive to the method of obtaining particles (hydrothermal method, method of precipitation from solution, sulfidation method, ultrasonic dispersion of macroscopic particles in solutions, etc.), technological conditions, for example, temperature and composition mixtures, exposure time, etc.

Also, a study of the Raman spectra of the obtained colloidal solutions after forty-minute treatment, lines characteristic of molybdenum trioxide was recorded. Based on this, it was suggested that during the formation of particles, there is a reaction of substitution of sulfur atoms from the MoS2 molecule with oxygen atoms, which leads to the formation of molybdenum trioxide.

It has been shown that with an increase in the processing time of colloidal solutions, it is possible to narrow the particle size distribution by approximately ~7.79 times. Thus, colloids containing a fraction of MoS2 particles with average sizes of 108 nm, 84 nm, 14 nm were obtained at a processing time of 20, 40 and 60 minutes, respectively.

The resulting colloidal solutions containing molybdenum disulfide nanoparticles currently have various fields of application, one of these is cancer theranostics, which includes therapy and diagnosis. The resulting nanoparticles can also be used to increase the sensitivity of markers responsible for detecting diseases.

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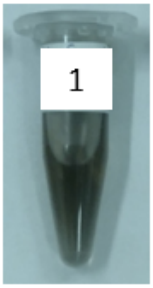
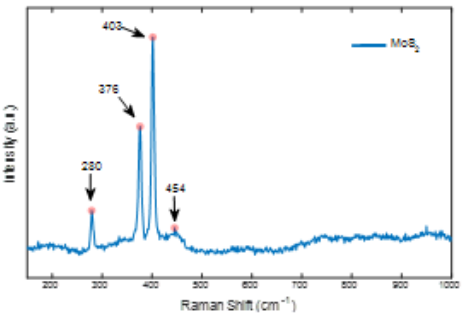
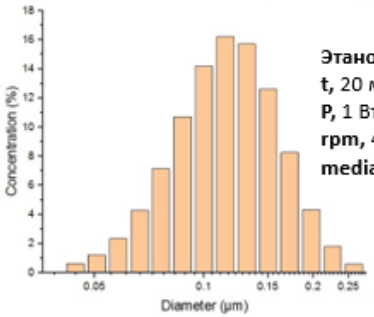
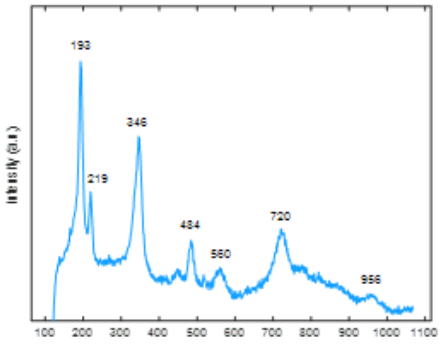
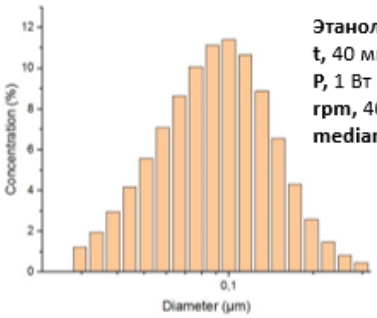






Этанол C_2H_6O
t, 20 мин
P, 1 Вт
rpm, 400 об/мин
median, 108.3 нм





Этанол C_2H_6O
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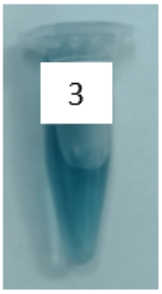
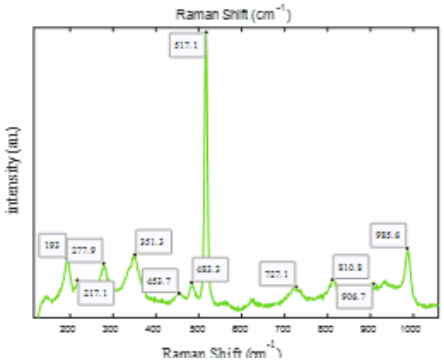
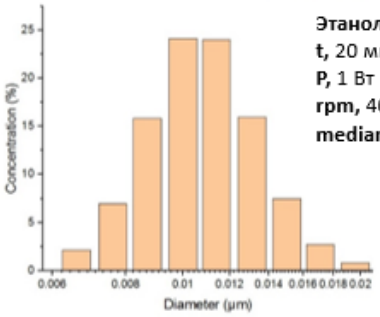
P, 1 Вт
rpm, 400 об/мин
median, 84.3 нм







Этанол C_2H_6O
t, 20 мин
P, 1 Вт
rpm, 400 об/мин
median, 13,9 нм