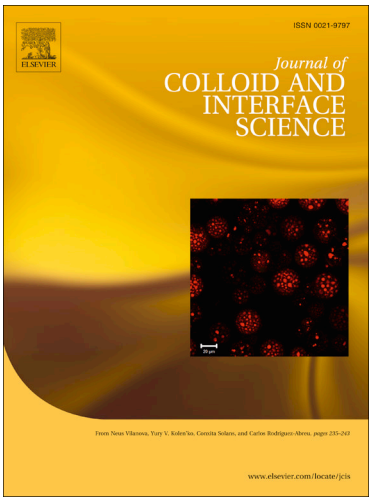

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Effective size selection of MoS_2 nanosheets by a novel liquid cascade centrifugation: influences of the flakes' dimensions on electrochemical and photoelectrochemical applications

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Abstract

Although liquid phase exfoliation is a powerful method to produce MoS_2 nanosheets in large scale, but its effectiveness is limited by the diversity of produced nanosheets sizes. Here a novel approach for separation of MoS_2 flakes having various lateral sizes and thicknesses based on the cascaded centrifugation has been introduced. This method involves a pre-separation step which is performed through low speed centrifugation to avoid the deposition of large area single and few-layers by the heavier particles. The bulk MoS_2 powders were dispersed in an aqueous solution of sodium cholate (SC) and sonicated for 12 h. The main separation step was performed using different speed centrifugation intervals of 10-11, 8-10, 6-8, 4-6, 2-4 and 0.5-2 krpm by which nanosheets containing 2, 4, 7, 8, 14, 18 and 29 layers were obtained respectively. The samples were characterized using XRD, FESEM, AFM, TEM, DLS and also UV-vis, Raman and PL spectroscopy measurements. Dynamic light scattering (DLS) measurements have confirmed the existence of a larger number of single or few-layers MoS_2 nanosheets compared to when the pre-separation step was not used. Finally, Photocurrent and cyclic voltammetry of different samples were measured and found that the flakes with bigger surface area had larger CV loop area. Our results provide a method for the preparation of a MoS_2 monolayer enriched suspension which can be used for different applications.

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