

Accepted Manuscript

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PII: S0001-8686(17)30141-0
DOI: doi: [10.1016/j.cis.2017.04.014](https://doi.org/10.1016/j.cis.2017.04.014)
Reference: CIS 1748

To appear in: *Advances in Colloid and Interface Science*



Please cite this article as: Ekaterina D. Grayfer, Mariia N. Kozlova, Vladimir E. Fedorov, Colloidal 2D nanosheets of MoS₂ and other transition metal dichalcogenides through liquid-phase exfoliation. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. *Cis*(2016), doi: [10.1016/j.cis.2017.04.014](https://doi.org/10.1016/j.cis.2017.04.014)

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Colloidal 2D nanosheets of MoS₂ and other transition metal dichalcogenides through liquid-phase exfoliation

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ABSTRACT

This review focuses on the exfoliation of transition metal dichalcogenides MQ₂ (TMD, M = Mo, W etc., Q = S, Se) in liquid media, leading to the formation of 2D nanosheets dispersed in colloids. Nowadays, colloidal dispersions of MoS₂, MoSe₂, WS₂ and other related materials are considered for a wide range of applications, including electronic and optoelectronic devices, energy storage and conversion, sensors for gases, catalysts and catalyst supports, biomedicine etc. We address various methods developed so far for transferring these materials from bulk to nanoscale thickness, and discuss their stabilization and factors influencing it. Long-time known exfoliation through Li intercalation has received renewed attention in recent years, and is recognized as a method yielding highest dispersed concentrations of single-layer MoS₂ and related materials. Latest trends in the intercalation/exfoliation approach include electrochemical lithium intercalation, experimenting with various intercalating agents, multi-step intercalation etc. On the other hand, direct sonication in solvents is a much simpler technique that allows one to

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