

Additive-free aqueous dispersions of two-dimensional materials: from biological investigations to chemical modifications

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Abstract

Solution processing is a strong enabler for the wide-spread incorporation of two-dimensional materials into a diverse scope of applications. Several of these materials have been exfoliated in liquids, most of which are organic in nature or stabilized using additives in water. Our work outlines the development of additive-free aqueous dispersions for a broad scope of applications via pre-processing steps. Of the several possibilities that such dispersions offer, we explored the implications of introducing transition metal dichalcogenides and hexagonal boron nitride in biological environments for the evaluation of their intrinsic cytotoxicity and enzymatic degradability, with the future outlook of their incorporation in transient bioelectronics. Besides biological investigations, such dispersions offer a wide scope of chemical modification through reactions that can be carried out in an aqueous media. By addressing the polydispersity in nanosheet size and utilizing the intrinsic chemical nature of these materials, we carried out the evaluation of reducing agent-free and spontaneous noble metal nanoparticle decoration onto the nanosheets of molybdenum disulfide for sensing, device fabrication and energy applications.

References

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Figures

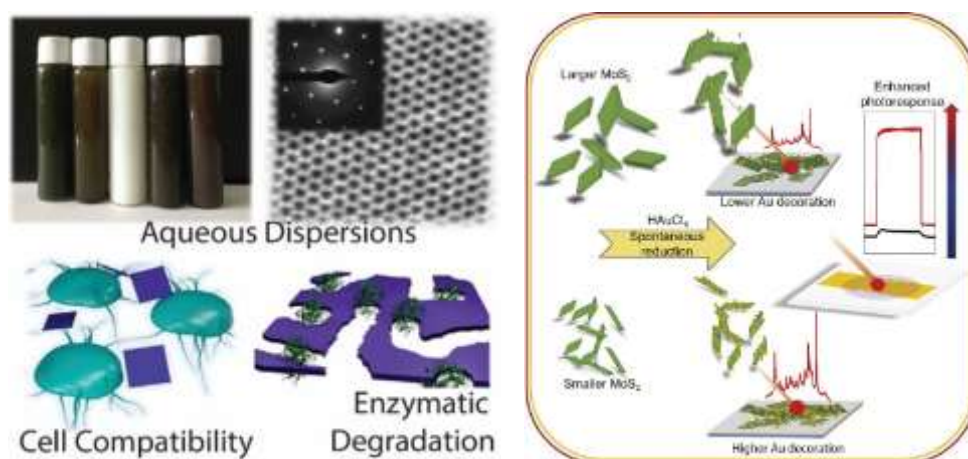


Figure 1: Additive-free aqueous dispersions for biological investigations, and for controlled noble metal nanoparticle decoration through size-selection of MoS₂.