Solution approach for smart asymmetric 2D heterostructures

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Asymmetrically decorated nanoparticles (NPs), also known as Janus NPs, possess two or more differently functionalised surfaces and this biphasic morphology gives rise to a complex coexistence of properties within one particle [1]. The general synthetic routes commonly designed for spherical NPs could also be extended towards less studied Janus two-dimensional (2D) monolayers. In general, asymmetric functionalisation of 2D materials is achieved through exposing their faces to different local environments, most commonly, by masking one of the surfaces with a substrate [2]. During past few years, considerable attention has been drawn towards asymmetric decoration of molybdenum disulfide (MoS_2) widely known for its appealing optoelectronic properties [3]. These properties can be finely tuned by designing heterostructures on the basis of semiconductive MoS_2 and switchable bistable molecular systems, such as spin-crossover (SCO) complexes. So far, the heterostructure reported by R. Torres Cavanillas et al. [4], based on SCO NPs covalently grafted on semiconductive MoS_2, was demonstrated to experience controllable modulation of its optoelectronic properties upon application of external stimuli. Meanwhile such symmetric hybrids had been successfully processed in solution, their asymmetric analogues are commonly prepared *via* physical deposition on a solid substrate [5]. In this work we aim to address this gap and explore the possibility of creating Janus-hybrid composed by SCO NPs covalently anchored onto semiconducting MoS_2 using solution approach assisted by easily removable polystyrene microspheres.

References

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Figures

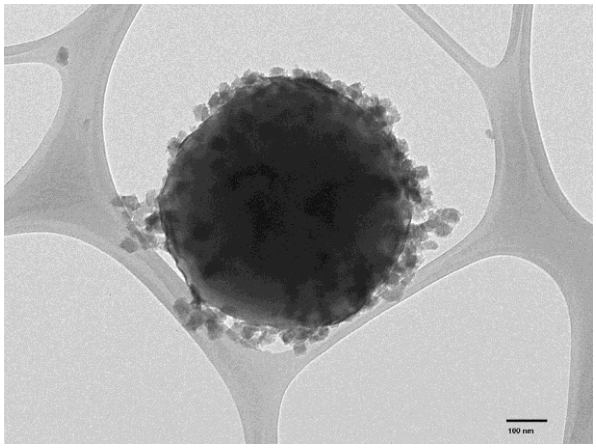

Figure 1: TEM image of SCO NPs grafted on exposed surface of MoS_2 deposited on polystyrene microsphere