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Kitchen inspired nanochemistry: dispersive, exfoliation and hybridization of functional MoS_2 nanosheets using culinary hydrocolloids[1]
SUDHIR RAVULA, JEREMY B. ESSNER, GARY A. BAKER, University of Missouri-Columbia — As a material, molybdenum disulfide (MoS_2) has drawn wide attention due to its broad applications and fascinating properties. In order to access its valuable properties, however, van der Waals interactions between the sheets within the bulk crystalline material must be overcome in order to produce stable single- or few-layer nanosheets (S/FLNS). Previous methods to exfoliate MoS_2 into nanoscale sheets were time consuming, employed expensive, environmentally unfriendly methods, or produced poorly stabilized nanosheets (yielding sheet aggregation). Known exfoliation methods also suffer poor scalability and reproducibility, making them ill-suited for the development of large scale devices and nanocomposites. In light of these facts, a simple and efficient approach to exfoliate bulk MoS_2 and generate stable S/FLNS using approaches that embrace the principles of green chemistry is long-awaited. We present results on the sonication-assisted aqueous phase exfoliation of bulk MoS_2 into dispersed S/FLNS using popular culinary agents, including guar gum, tannic acid, and xanthan gum. Subsequent decoration of the sterically-stabilized nanosheets with gold nanoparticles via in situ reduction by the sorbed culinary agent gave a plasmonic nanocatalyst hybrid exhibiting excellent activity toward 4-nitrophenol reduction using sodium borohydride. These agents are green and inexpensively available commercially, opening up interesting possibilities that will be discussed.

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