|  |  |  |  |
| --- | --- | --- | --- |
| Title | Facile high-yield synthesis of MoS2 nanosheets with enhanced photocatalytic performance using ultrasound driven exfoliation technique | | |
| Author(s) Name | Subrata Das, Angkita Mistry Tama, Sagar Dutta, Md. Shahjahan Ali and M A Basith | | |
| Contact Email(s) | [angkitatamabd@gmail.com](mailto:angkitatamabd@gmail.com)  angkitatama@aiub.edu | | |
| Published Journal Name | Materials Research Express | | |
| Type of Publication | Journal Paper | | |
| Volume | 6 | Issue | 12 |
| Publisher | IOP Publishing Ltd. | | |
| Publication Date | 4 December 2019 | | |
| ISSN | 2053-1591 | | |
| DOI | 10.1088/2053-1591/ab57dd | | |
| URL | https://dx.doi.org/10.1088/2053-1591/ab57dd | | |
| Other Related Info. |  | | |
|  | | | |

|  |  |
| --- | --- |
| Abstract |  |
| We have demonstrated a facile one-step ultrasound driven exfoliation technique for the synthesis of few-layer MoS2 nanosheets from bulk MoS2 powder with a yield of almost 60%. Structural, morphological and optical characterizations of non-ultrasonicated and ultrasonicated MoS2 are carried out in nominally identical conditions to make a direct comparison between their properties. The Rietveld refined powder x-ray diffraction patterns elucidate the semiconducting 2H phase of MoS2 nanosheets without any structural deformation caused by ultrasonication. Field emission scanning electron microscopy ensures the successful formation of ultrathin MoS2 nanosheets having thickness in the range of 8–15 nm. The ultrasonicated MoS2 nanosheets demonstrate considerably higher absorbance in the visible spectra compared to their non-ultrasonicated counterpart. A slight enhancement is observed in the optical indirect bandgap of exfoliated MoS2 nanosheets which is further confirmed by first-principles calculations. The photoluminescence spectroscopy reveals the enhanced potential of ultrasonicated MoS2 to suppress photogenerated carrier recombination phenomenon. The ultrasonicated MoS2 manifests considerably better performance in photocatalytic degradation of rhodamine B (RhB) dye under visible light irradiation as compared to non-ultrasonicated MoS2. Further, addition of H2O2 in the solution has enabled ultrasonicated MoS2 nanosheets to photodegrade 100% of RhB dye within only 1 h and 40 min. The outcome of our investigation suggests that this ultrasound assisted exfoliation technique can be effectively employed as a rapid and efficient route for the large-scale synthesis of few-layer ultrathin MoS2 nanosheets with superior photocatalytic performance. The synthesized MoS2 nanosheets may further lead to engineering heterogeneous structures of different photocatalysts having promising potential for numerous applications. | |