PlasmaAssisted preparation of ZnS and ZnO Nanomaterials and Plasma-Nano Treatment of PollutantDyes

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Oxide and sulfides of Zinc is used for great many technologically valuableapplications such as biological, environmental protection and energyproduction/storage. This work deals with the a).Soft jet plasma (APPJ) assistedsynthesis of Zinc oxide, Zinc sulfide nanomaterials (NMs) and its composites powderwith focus on size and shape selective preparation and b).Plasma-nano catalysisof industrial dyes (methylene blue (MB) and malachite green (MG)) with maximumdegradation at shorter time. The APPJ assisted synthesis has many advantagesover other methods such as low temperature processing, efficient control overparticle surface morphology, short reaction time, possibility to bulkproduction and no need for the addition of surfactant molecules. The plasmaexposure time was maintained 1 hour for all experiments but the types ofprecursors and concentration were varied to achieve different surfacemorphology. The ZnO NMs prepared by APPJ exhibited rod/needle-like, flower-likeand layer like surface features. At the same time, ZnS exhibited mainlylayers-like and in few cases spherical aggregates. The ZnO+ZnS compositesshowed mixed morphology according to the dominance. It seems that oxides areeasier to control than sulfides in terms of surface morphology using APPJ. The NMsexhibiting different surface morphology were tested for the catalysis of MB andMG dyes. The role of surface morphology, plasma exposure and combined plasma-nanocatalytic effect were investigated. It was noted that APPJ plasma itselfcatalyzes the dyes which was concentration dependent but at the same time,utilizing ZnO, ZnS and its composites provided the synergistic (plasma-nano)effect thus further enhancement in the dye degradation rate was achieved.

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