Polymer Encapsulation of Semiconductor Nanoparticles via Surface-Initiated Aerosol Photopolymerization

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The work presented here describes a facile approach toward the in situ coating of various semiconductor nanoparticles (SNs) including ZnO, TiO_2, and Fe_3O_4 with a hydrophobic polymer shell by aerosol-photopolymerization [1]. This method is based on heterogeneous condensation of monomer vapor around the surface of gas-born SNs, which is then polymerized ‘‘in flight’’ under UV light irradiation within the average aerosol residence time of 35 s (Figure 1). Most importantly, these SNs act not only as cores, but at the same time as photoinitiators.

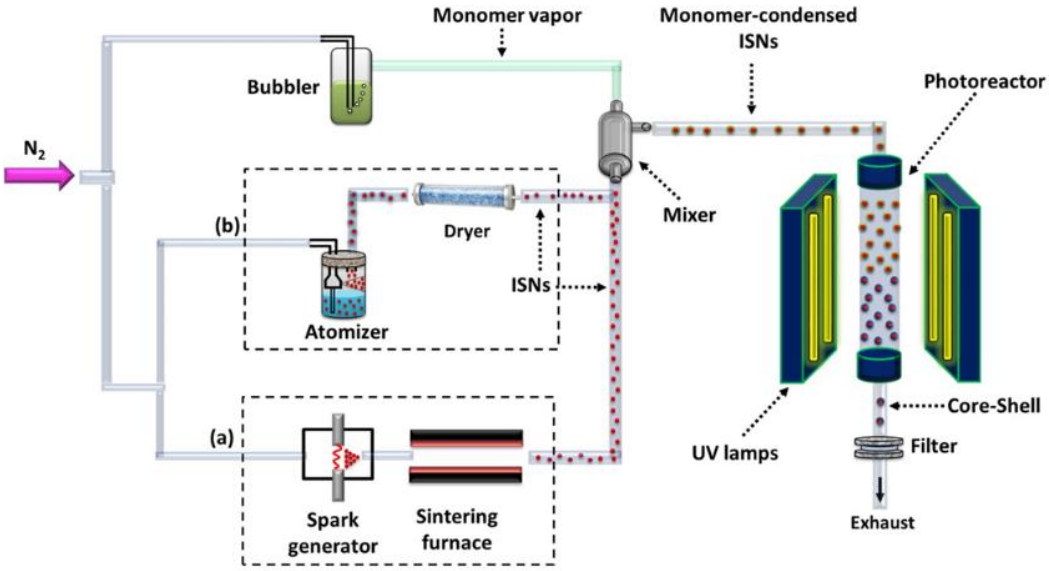

Figure 1. Schematic diagram of the continuous experimental setup for aerosol based fabrication of core-shell materials.

The TEM image (Figure 2) revealed that various SNs can be coated successfully with a polymer shell by the continuous aerosol-photopolymerization.

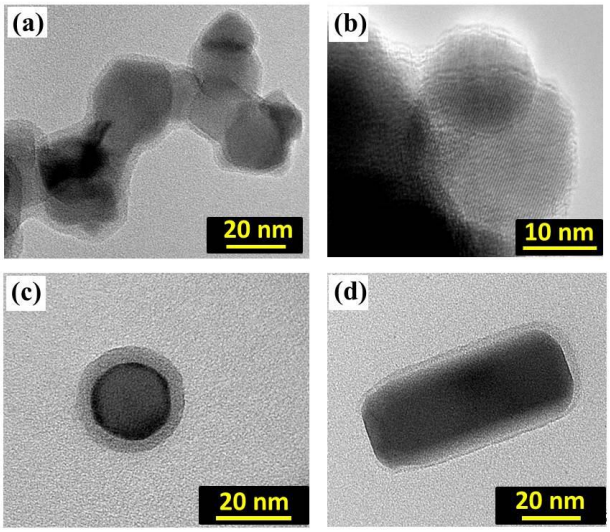

Figure 2. TEM images of polymer coated (a) TiO_2 P25 nanoparticles, (b) magnetic Fe_3O_4 nanoparticles, (c) spherical ZnO nanoparticles, and (d) rod-like ZnO nanoparticles.

Change in the surface hydrophobicity of magnetic nanoparticles after the encapsulation with polymer shell was clearly confirmed by their preference for organic solvent as manifested in Figure 3.

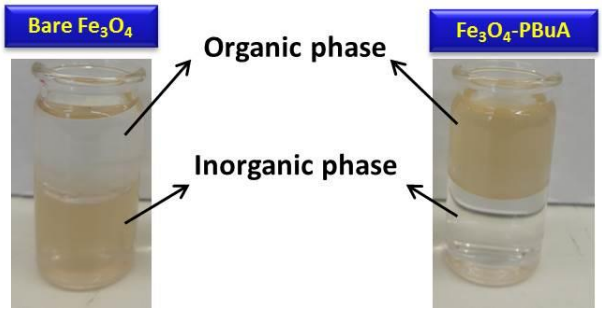

Figure 3. Photographs of (a) the bare Fe_3O_4 nanoparticles and (b) Fe_3O_4-PBuA core-shell nanoparticles that were dispersed in a mixture of cyclohexane (upper) and water (lower).

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References:

[1] Shaban M., J. Poostforooshan and A.P. Weber, *Journal of Materials Chemistry A*, **2017**, 5.35, 18651-18663.