Amphiphile-assisted synthesis of silica@graphite via a sol-gel reaction

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Although graphite has excellent thermal conductivity of 200-800 W/mK, there are definite limits when applying graphite to thermally conductive materials, e.g. as a coating material for printed circuit boards (PCB), an additive to the adhesive for the assembly of electronic chips, and a filler for thermal spreader pads.1-3 The problems are largely attributable to the electrically conductive property. To endow graphite with an electrically insulating property, graphite was coated with a well-grown silica layer using polyethylene glycol (PEG) as a cohesive promotor. Tetra orthoethylsilicate (TEOS) was used as the silica precursor, and polyethylene glycol (PEG) was used to improve the cohesion between graphite and silica. An alumina-coating on graphite was conducted by a base-catalyzed sol-gel reaction. The changes in the morphology and the amounts of coated silica, as well as the electrically insulating properties resulting from them were investigated. An optimized condition to make Silica@PEG@graphite was determined by changing the amounts of TEOS and PEG. The synthesized Silica@PEG@graphite was categorized as an electrical insulator with a high surface resistivity of about 10^{12} ohm/sq.