

Synthesis and magnetic properties of highly dispersed tantalum carbide nanoparticles decorated on carbon spheres

Bhattacharjee K
Chatterjee TN
Pati SP
Das GC
Ray SS
Maity A

ABSTRACT:

The decoration of carbon spheres (CS) by highly dispersed tantalum carbide nanoparticles (TaC NPs) was achieved, for the first time by a unique carbothermal reduction method at 1350 °C for 30 min under reduced oxygen partial pressure. TaC NPs decorated CS composites were then extensively characterized by powder X-ray diffraction and electron microscopy techniques. The composite spheres were approximately 0.8–1 μm in diameter with an average size of 41 nm for the TaC NPs located at the surface. Transmission electron microscopy and Raman analysis showed the formation of the graphene layer at the outer surface of the TaC NPs. An anomalous ferromagnetic response with a spin-glass like behavior has been observed at low temperature in the dc magnetization study with complete suppression of the superconducting response. For ease of synthesis and high reproducibility, this technique opens a new paradigm in the preparation of carbon sphere supported high melting metal carbide nanoparticles for various technological purposes.