Synthesis carbon-encaspsulated metal nanoparticles by a detonation method

Hao Y.[1], Pengwan C.*[1]

[1]*State Key Laboratory of Explosive Science and Technology, Beijing Institute of Technology, 100081 ,Beijing, PR China*
** e-mail: pwchen@bit.edu.cn*

Nanosized metal/carbon-composite systems are considerable concern because of their possibility for magnetic materials[1], catalysts[2], electrode in batteries[3], against oxidization and further agglomeration to form bigger crystallites[4] and so on.

Uniform carbon-encapsulated metal-based nanoparticles with a well-constructed core–shell structure(see Fig.1) were produced by detonation decomposition of explosive mixture precursors containing metal ion components in a vacuum detonations vessel, which is characterized by a self-heating, extremely faSt process and cost-efficient. The C/metal-ion ratio of origin materials was a key factor which determines the formations of carbon - encapsulated metal or metal carbide nanoparticles. The different sizes of the nanocrystal core and the thickness of the carbon shell were yielded by adjusting the component materials of the explosive precursors during the course of these detonation reactions.

HRSEM,HRTEM,XRD, DTA/TG were used to studied composition and morphology of nanoparticles. The magnetic properties of encapsulates were also measured. Results showed that the diameters of nanoparticles are 10-50 nm, metal/ metal carbide cores and graphitic/amorphous shells are formed in these nanoparticles. The carbon shells could protect effectively the cores againSt the attack of either strong acid or strong base solution. The thickness of the carbon shells are 3-10nm with 10-30 layers. The interlamellar spacing, which is approximately equal to the distance between graphite layers, is about 0.34 nm. The nanoparticles showed the properties of superparamagnetism.

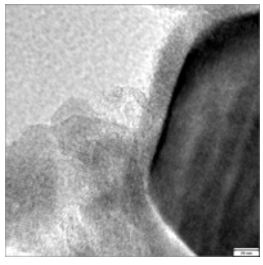

Figure.1. HR TEM images of nanoparticle.

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