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DC アーク放電生成グラファイト外包金ナノ微粒子のプラズマ表面官能基修飾

Plasma Surface Modification with Functional Groups of Graphite Encapsulated Gold Nanoparticles Prepared by DC Arc Discharge

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1. Introduction

In this research, we have developed a plasma processing technology to functionalize the surface properties of nano-structured materials for biomedical applications. The experimental study was conducted including 3 steps: Firstly, the metallic nanoparticles are fabricated using a one-step DC-arc discharge method; Secondly, the fabricated nanoparticles' surface was modified by RF plasma treatment and To apply them to various medical fields, the nanoparticles should be functionalized for improving biocompatibility and dispersion property. Thus, finally, the nanoparticles were immobilized by some macro bio-molecular for checking the capability for further medical use. We have succeeded in fabrication of graphite-encapsulated magnetic(Fe, Ni, Co, Sm, Nd) nanoparticles and recently gold nanoparticles with a varying diameter of 10~70 nm till now. We also demonstrated amino group introduction onto the surface of graphite-encapsulated metallic nanoparticles using low-pressure Ar/ammonia plasma treatments.

2. Experiment Result and Discussion

All popular characterizations for nanomaterial were made on the fabricated metallic nanoparticles of before and after the RF plasma treatment including SEM, TEM, EDS, XPS, XRD and so on to confirm the nanoparticles' performance.

As it is well known that gold nanoparticles (AuNPs) is a very good candidate in nano-medical and nano-medicinal fields, in view of that consideration, we carried out the fabrication of graphite-encapsulated gold nanoparticles by the DC arc discharge (as shown in Fig. 1) and the characterization for them mentioned above.

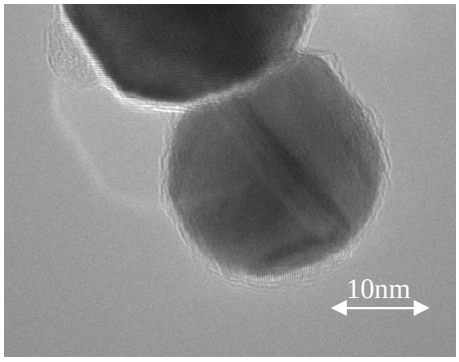

Fig.1　TEM image of graphite encapsulated Au nanoparticles.

Fig. 2 shows XPS spectra of the fabricated gold nanoparticles, where the binding energy data was referred to the NIST XPS database (http://srdata.nist.gov/xps/). It shows that the particles are mainly composed of carbon and gold. XRD spectra also show the peaks of graphite and crystalline Au. More details of characterization data of graphite-encapsulated gold nanoparticles will be presented at the conference together with the preliminary results of their surface modification by RF plasma processing.

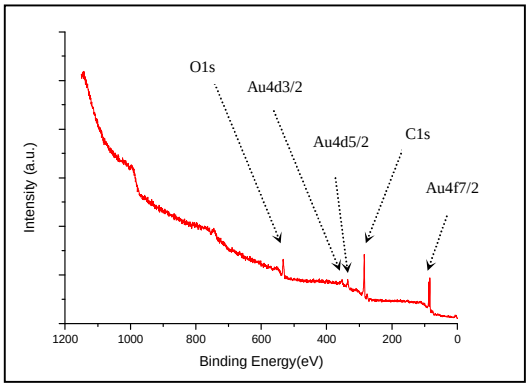

Fig. 2 XPS wide scan spectra of graphite encapsulated Au nanoparticles.