高圧気液界面放電プラズマによる金属/カーボンナノ複合材料の合成

Synthesis of Metal/carbon Nanocomposite by Gas/liquid Discharge Plasma under High Pressure

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In the present work, metal-based nanoparticles (NPs) encapsulated by the carbon nanosheets were synthesized through a one-step method by pulsed arc discharge plasma over the Ar/water interface under high pressure. The carbon nanosheets are formed from glycine dissolved in the water phase, which is an abundant, cheap, and environmental-friendly carbon precursor while metal-based NPs are generated instantaneously from metal electrodes. The experiments were conducted in the 100 g/L glycine solution at room temperature with the pressurized Ar gas at 0-4.0 MPa, the high-voltage of 18.6 kV supplied by DC pulsed power In the experiment, Ag, Ti, and Fe, three kinds of metal rods have been used as the anode to fabricate metal/carbon nanocomposites.

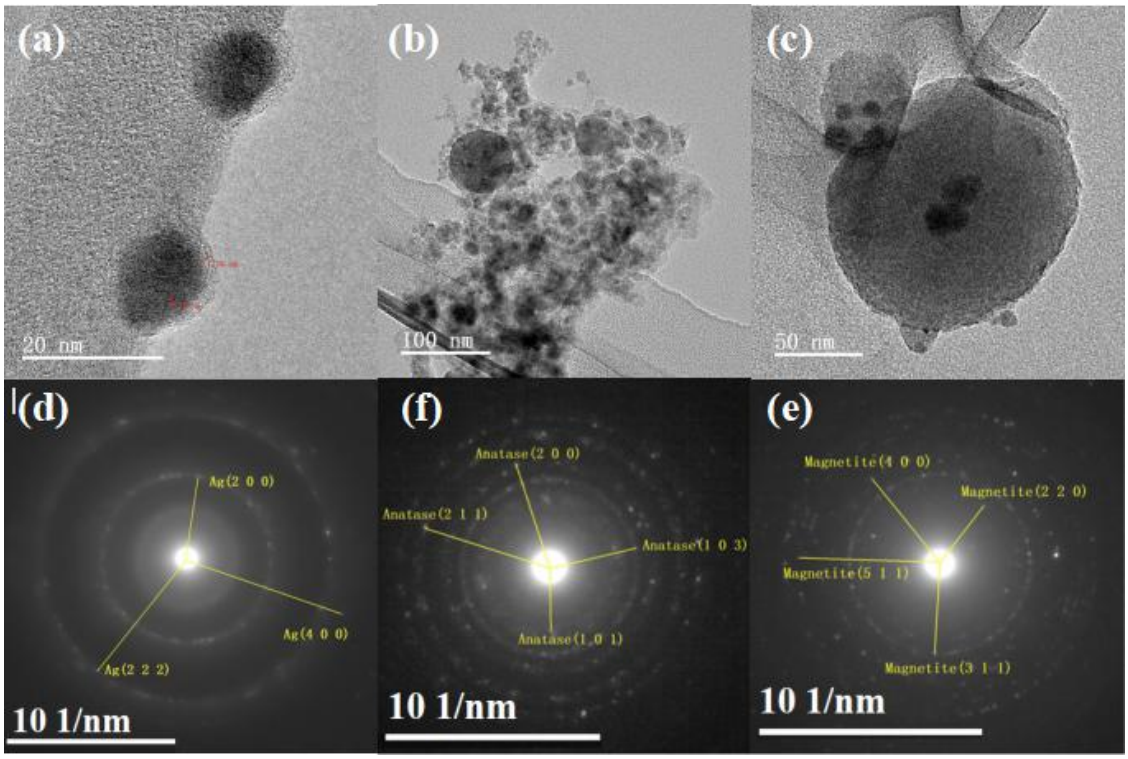

Fig.1. HRTEM and SAED pattern of (a,d) Ag/C nanocomposite, (b,e) TiO_2/C nanocomposite; (c,f) Fe_3O_4/C nanocomposite

The HRTEM coupled with SAED (shown as the Fig.1) indicated that Ag, TiO_2, and Fe_3O_4 NPs successfully produced in uniform size around 10 nm are decorated on the amorphous carbon nanosheets. The effects of plasma parameters on the size distribution of the metal-based NPs have been studied by adjusting the Ar gas pressure, pulse frequency, and solution conductivity. With the increased gas pressure and the pulse frequency, the size of the metal-based NPs decreased. However, the solution conductivity showed no effect of the metal-based NPs.