Facile synthesis of Iron oxide nanoparticles using Atmospheric-Pressure Microplasmas

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Iron oxide nanoparticles (NPs) have been reported a new class of novel nanomaterials with exceptional properties including superior magnetic properties, biocompatibility and high surface area, and could be potentially used for emerging applications including biosensing, drug delivery, pollutant treatment, energy storage and catalysts. While co-precipitation method is the most common technology to produce Iron oxide nanoparticles, it is still difficult to control the particle size and size distribution in a simple manner. Moreover, toxic chemicals and strong reducing agents such as NaOH and NaBH4 are usually needed. Consequently, it is required to develop a simple, green and scalable method to produce iron oxide NPs to realize their commercialization.

Here we present a facile synthesis iron oxide NPs using a novel atmospheric-pressure microplasma-assisted electrochemistry. Microplasmas are defined as gaseous discharges formed in electrode geometries where at least one dimension is less than 1mm. Additionally, microplasmas can be operated with an aqueous solution as an electrode. Energetic species formed in the microplasma are capable of initiating electrochemical reactions and nucleating particles in solution without the need for a chemical reducing agent. In our experiments result, we found nanoscale iron oxide NPs can be synthesis using atmospheric-pressure-microplasma-assisted electrochemistry. Furthermore, we synthesis Fe_3O_4/Carbon materials composite under the microplasma system as multifunctional nanostructures. As-produced samples were characterized by XRD, Raman and UV-Vis spectroscopy. We found that process parameters including plasma current, time and precursor concentrations are key factors to control the production yield and particle morphologies.

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