Influence of plasma reactor parameters on carbon coating of iron nanoparticle

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Despite of numerous interests in iron nanoparticles (INPs), its rapid environmental degradation is still a serious problem; which limits the advantages of superparamagnetic properties and its potential applications. To overcome this difficulty, carbon coating is one of the best solutions for protecting INPs. Furthermore, carbon coating can improve electrical conductivity, mechanical performance and biocompatibility of the materials [1]. In this research, plasma method is used to synthesize carbon coated iron nanoparticle (CCINPs). The effective parameters on morphologies and carbon shell protection were studied. Based on the images taken by transmission electron microscopy (TEM), INPs were produced and partially coated (Figure 1). By increasing current and pressure condition up to atmospheric pressure and despite of increasing iron precursor concentration from 0.5% to 3.5% (seven times), we observed that INPs were completely coated by carbon shell.
Figure 2 Illustrate complete coating of a single INPs. Besides, the absence of oxygen in the nanoparticles has been determined by energy-dispersive X-ray analysis as it's shown in Figure 3. The reported results of the magnetic characterization of CCINPs show their superparamagnetic nature and the total absence of oxidation due to the high sealing efficiency of carbon shell.

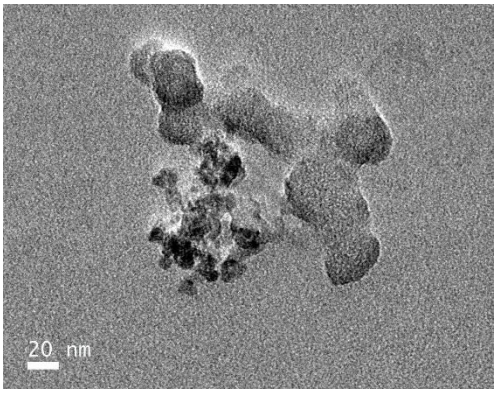

Figure 1. TEM image of partially coated INPs

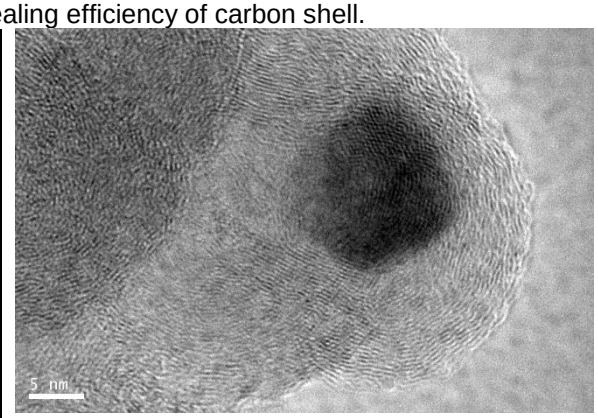

Figure 2. TEM image of a CCINPs

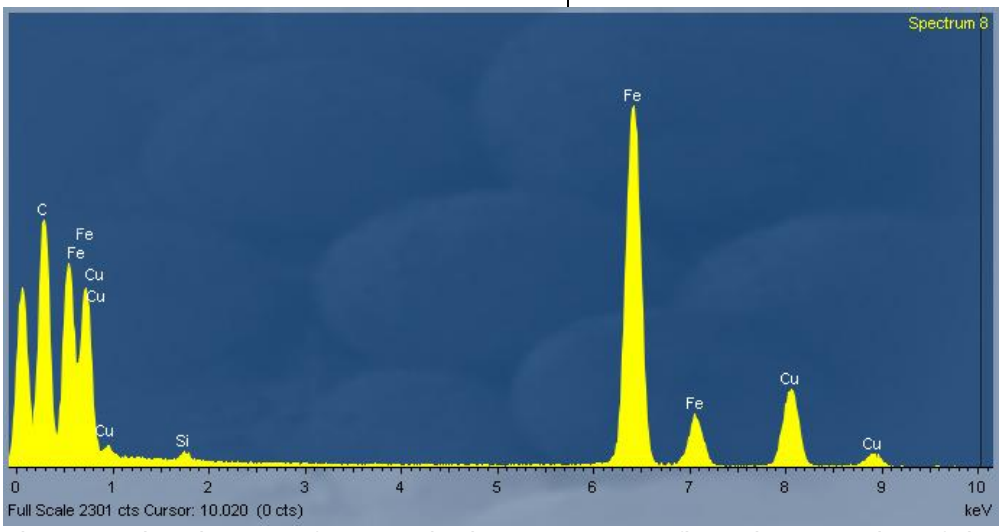

Figure 3. The absence of oxygen in the spectrum confirms the protection of the nanoparticles from oxidation.

Reference:
1- S. Liu, X. Tang, Y. Mastai, I. Felnerc and A. Gedanken, Nanoscale, 2 (2010) 2281-2285.