Magnetite synthesis by calcination of sucrose

Débora L. Paiva¹ (IC), Ângela L. Andrade¹* (PQ), José D. Fabris²,4 (PQ), José D. Ardisson³ (PQ), Rosana Z. Domingues⁴ (PQ).

¹Department of Chemistry ICEB, Federal University of Ouro Preto, 35400-000 Ouro Preto, MG.
²Federal University of the Jequitinhonha and Mucuri Valleys (UFVJM), 39100-000 Diamantina, MG.
³Laboratory of Applied Physics, CDTN, 31270-901 Belo Horizonte, MG.
⁴Department of Chemistry ICEx, Federal University of Minas Gerais (UFMG), 31270-901 Belo Horizonte, MG.

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Introduction

Real benefits of nanotechnology both in industrial processes and in medicine are being inimitable. The way nanoparticles are synthesized may determine their morphological uniformity, their particle sizes distribution and, as a critical feature for clinical purposes, their purity. In this work magnetite nanoparticles were synthesized by reducing the chemical oxidation state of iron in a commercial synthetic maghemite. The direct solid-state chemical conversion procedure that was first used by Pereira¹ to obtain magnetite by mixing and burning a natural hematite (\(\gamma\text{Fe}_2\text{O}_3\)) with glucose was found unsuccessful, in the present case. Instead, the magnetite could only be effectively produced by putting the reacting mixture of the starting synthetic commercial maghemite (Sigma-Aldrich # 544884-25) mixed with sucrose in two inversely coupled crucibles in a furnace at 400 °C for 20 min.

Results and Discussion

The samples were characterized by Mössbauer spectroscopy, XRD, and FTIR. The 298 K-Mössbauer spectrum collected for the starting commercial maghemite, as received, and the corresponding parameters are given in Figure 1 and Table 1. Figure 2 shows the spectrum and the corresponding parameters (Table 2) for the obtained magnetite by using a mass ratio maghemite:sucrose of 1:5.

Conclusions

This newly adapted method to obtain uniformly-sized, clean material of pure magnetite, through solid state chemical reduction of hematite of known sizes, confirms its real perspectives on the production of magnetic nanoparticles that can be suitably used in medical practices, as in magnetically-assisted therapies, in oncology, for being nearly non-toxic to humans and for their...
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