

## Accepted Manuscript

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PII: S0032-5910(17)30501-6  
DOI: doi:[10.1016/j.powtec.2017.06.042](https://doi.org/10.1016/j.powtec.2017.06.042)  
Reference: PTEC 12618

To appear in: *Powder Technology*

Received date: 12 November 2016  
Revised date: 24 March 2017  
Accepted date: 17 June 2017



Please cite this article as: Jinghai Yang, Qiangwei Kou, Yang Liu, Dandan Wang, Ziyang Lu, Lei Chen, Yuanyuan Zhang, Yaxin Wang, Yongjun Zhang, Donglai Han, Scott Xing, Effects of amount of benzyl ether and reaction time on the shape and magnetic properties of  $\text{Fe}_3\text{O}_4$  nanocrystals, *Powder Technology* (2017), doi:[10.1016/j.powtec.2017.06.042](https://doi.org/10.1016/j.powtec.2017.06.042)

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## Effects of amount of benzyl ether and reaction time on the shape and magnetic properties of Fe<sub>3</sub>O<sub>4</sub> nanocrystals

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### Abstract

Magnetite Fe<sub>3</sub>O<sub>4</sub> nanoparticles (NPs) have attracted much interest due to their low toxicity, good biological compatibility and fast response to an external magnetic field. The magnetite Fe<sub>3</sub>O<sub>4</sub>NPs with different shapes and sizes were successfully prepared by the thermal decomposition method. The effects of the amount of solvent and the reaction time on the morphologies and the magnetic properties of magnetite Fe<sub>3</sub>O<sub>4</sub> NPs were investigated comprehensively. A series of testing methods including X-ray diffraction (XRD), Fourier transform infrared (FT-IR), X-ray photoelectron spectroscopy (XPS) and Mössbauer spectrum testified that the as-obtained samples were pure magnetite phase. Scanning electron microscopy (SEM) and transmission electron microscope (TEM) indicated the amount of solvent and the reaction time could tune the shape and size of Fe<sub>3</sub>O<sub>4</sub> NPs. The truncated cube and octahedron were the intergradations for the cube. The oleic acid played an important role in inhibiting the crystal growth along the <100> direction and accelerating that along the <111> direction of magnetite. The variation trend of the saturation magnetization (*M<sub>s</sub>*) was in agreement with that of the particle size, which was attributed the contribution from the small-size effect or surface effect. The variation of the coercivity (*H<sub>c</sub>*) depended on that of the magnetic anisotropy, the surface anisotropy or the shape anisotropy.

**Keywords:** Fe<sub>3</sub>O<sub>4</sub>; Nanocubes; Shape control; Structure; Magnetic properties.

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