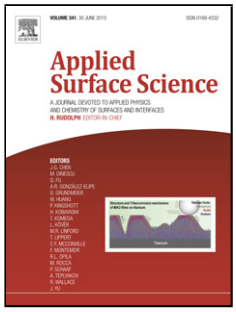


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PII: S0169-4332(17)30481-6
DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2017.02.118
Reference: APSUSC 35227

To appear in: *APSUSC*

Received date: 6-10-2016
Revised date: 16-1-2017
Accepted date: 14-2-2017

Please cite this article as: Krzysztof Cendrowski, Pawel Sikora, Beata Zielinska, Elzbieta Horszczaruk, Ewa Mijowska, Chemical and thermal stability of core-shelled magnetite nanoparticles and solid silica, Applied Surface Science http://dx.doi.org/10.1016/j.apsusc.2017.02.118

# Chemical and thermal stability of core-shelled magnetite nanoparticles and solid silica

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**Highlights**

- Enhancement of the iron oxide thermal stability with the solid silica shell.
- Advantage of solid over porous silica shell protection from the acid corrosion.
- The influence of the $Fe_3O_4/SiO_2$ thermal treatment on the acid corrosion resistance.

**Abstract**

Pristine nanoparticles of magnetite were coated by solid silica shell forming core/shell structure. 20 nm thick silica coating significantly enhanced the chemical and thermal stability of the iron oxide. Chemical and thermal stability of this structure has been compared to the magnetite coated by mesoporous shell and pristine magnetite nanoparticles. It is assumed that six-membered silica rings in a solid silica shell limit the rate of oxygen diffusion during thermal treatment in air and prevent the access of HCl molecules to the core during chemical etching. Therefore, the core/shell structure with a solid shell requires a longer time to induce the oxidation of iron oxide to a higher oxidation state and, basically, even strong concentrated acid such as HCl is not able to dissolve it totally in one month. This leads to the desired performance of the material in potential applications such as catalysis and environmental protection.

**Keywords:** Magnetite, $Fe_3O_4$, silica coatings, core-shell nanostructures, chemical resistant, thermal stability,