

## Structural, Optical and Electrical Properties of Sol–Gel Prepared Mesoporous Co<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub> Nanocomposites

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### ABSTRACT

Structures, optical and electrical properties of Co<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub> nanocomposites are reported. Well crystalline Co<sub>3</sub>O<sub>4</sub> nanoparticles embedded in an amorphous SiO<sub>2</sub> matrix is formed, and confirmed by XRD and FTIR measurements upon calcination of gel precursors up to 800 °C. The obtained nanocomposites have high surface area ~126–312 m<sup>2</sup> g<sup>-1</sup>, and the Co<sub>3</sub>O<sub>4</sub> particle size was ~7–15 nm. The optical properties of the Co<sub>3</sub>O<sub>4</sub>/SiO<sub>2</sub> nanocomposites indicate the presence of two energy gaps; both of them are smaller than those reported for the Co<sub>3</sub>O<sub>4</sub> bulk phase. The first is varied from 1.32 to 1.44 eV and the second one is varied from 1.76 to 1.87 eV depending on the particles size. DC conductivity was measured in the temperatures range 300–673 K. The activation energy for DC conduction varies with particle size. The conduction mechanism was suggested to be through small polarons and variable range hopping mechanisms, at high and low temperatures respectively.

**KEYWORDS:** Cobalt oxide/silica; Nanocomposite; Mesoporous structure; Optical properties; Electrical conductivity

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