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Electrophoretic Deposition of $CoFe_2O_4$ nanograins dispersed in a $BaTiO_3$ matrix

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Nanostructured materials presenting a coupling between the electric and magnetic degrees of freedom have been attracting much scientific and technological interest. By combining a piezoelectric ceramic and a magnetostrictive material, the elastic interactions between the phases provide the coupling mechanism inducing a magnetoelectric behavior.

In electrophoretic deposition (EPD), an electric field is applied on a suspension of charged particles that move towards an electrode and are deposited on it. Due to this, very small nanoscopic particles can be deposited by EPD. As such, a nanostructure can be built where dispersed grains of the magnetostrictive phase are covered with a piezoelectric film that fills the voids between them. The final structure can be considered as a bilayer composite film, where the interface area between the phases is increased relative to typical bilayers films. Here, composites of electrophoretic deposited cobalt ferrite ($CoFe_2O_4$-magnetostrictive) nanograins were dispersed in a laser ablated barium titanate ($BaTiO_3$-piezoelectric).

Evidence of stress mediated coupling between the two phases, was found by magnetic field dependent Raman spectroscopy. In the presence of a magnetic field, changes on $CoFe_2O_4$ T-site and $BaTiO_3$ E(TO)+ A_1(TO) modes positions were observed and ascribed to magnetic field induced stresses.