Synthesis of Ni nanoparticles in lanthanum chromite ceramic matrix

Victor Buratto Tinti[1], Fábio Coral Fonseca[2], Daniel Zanetti de Florio[1]

[1]Universidade Federal do ABC, [2]Instituto de Pesquisas Energéticas e Nucleares

e-mail: victor.buratto@aluno.ufabc.edu.br

Lanthanum chromite is a well-known interconnector for solid oxide fuel cells. It presents electronic conductivity at high temperatures. Moreover it is very stable in oxidizing and reducing atmospheres. Due to its high stability this material is a promising matrix to produce and stabilize nanoparticles by exothermal reaction. The objective of the present work is to synthesize and stabilize nickel nanoparticles in a stable ceramic matrix. Compounds of $(La_{1-x}Sr_x)_a(Cr_{1-y}Ni_y)O_3$ (x and y = 0, 0.1, and 0.2; a = 1, and 0.8) were synthesized by Pechini method. The powders were heat treated in air at 1300 °C and 1600°C in attempt to solubilize NiO in the matrix. Then the samples were exposed to a reducing treatment in $H_{2(g)}$ flux at 900°C per 8 hours. XRD measurements were made using a D8 Focus, Bruker AXS. The data was acquired in a range of 2θ from 20° to 90°, with a step of 0,02° per second. Magnetic properties were investigated utilizing a SQUID-VSM from Quantum Design. Magnetic moment at constant magnetic field (100 Oe and 1000 Oe) was measured in a range of 2K to 300K. Analyses with variable magnetic field were performed at 2K, 196K and 390K in a rage from -5 up to 5 T. Samples were observed using TEM technique. The XRD results showed that the stoichiometric samples achieved desiderate phase. Compounds without Sr and non-stoichiometric lanthanum site showed an incomplete nickel solid solution. The addition of 10% of Sr decreases the Néel temperature from 289 K to 285K. Ni doping created a stronger effect, lowering the temperature down to 267 K , in the sample with 10% of dopant. After reduction is possible to observe peaks of Ni in the XRD, indicating that nickel was exoluted form the matrix. Images of TEM confirm the presence of nanoparticles with an approximate diameter of 3 nm. The reducing treatment increased the magnetic response.