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XAS, XRD and Raman study on nanostructured CeO2-Gd2O3 solid solutions

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Ceria (CeO2) and ceria-based materials have received a lot of attention for many technological applications since they exhibit a number of interesting properties, including high ionic conductivity and excellent catalytic performance for oxidation reactions. The incorporation of metal oxide in the CeO2 structure significantly improves the oxygen storage capacity, ionic conductivity and surface area of these materials. Doped ceria (CeO2-Gd2O3, -Y2O3, -Sm2O3) is considered as a promising candidate for electrolytes in intermediate temperature solid oxide fuel cells (IT-SOFCs). Moreover, composite of doped ceria and a metal phase (Ni, Cu, Pt or Pd) have shown excellent performance as anode for IT-SOFCs.
Recent researches have shown that reducing the crystallite size in the nanometric or even submicrometric range significantly improves the ionic transport properties and catalytic performance of these materials. This work aims at revealing size dependent structural feature in CeO2-Gd2O3 (GDC) solid solutions by XRD, XAS and Raman spectroscopy. We have studied GDC powders with a composition of Ce0.8Gd0.2O1.9 treated at different temperature in order to yield crystallite sizes ranging from 5 to above 100 nm. The use of complementary techniques provided information on the long range and local order of these materials as a function of crystallite size. The influence of the crystallite size on the defect structure can be a key in understanding the properties of the nanostructured GDC.

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