Centre of Excellence for Optical Spectroscopy Applications in Physics, Material Science and Environmental Protection

Appendix J:

Report

Project no. **INCO-CT-2006-026283-OPSA**

Project title:

Centre of Excellence for Optical Spectroscopy Applications in Physics, Material Science and Environmental Protection

Presentation of the OPSA project at EUROPOLES, Paris

Appendix J:
Presentation of the OPSA project at EUROPOLES, Paris

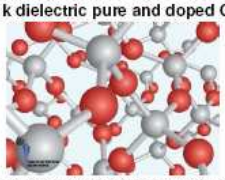
SERBIA

EUROPOLES, European Networking Event

Europe meets in Paris, June 2nd 2009

Center for Solid State Physics and New Materials

Multifunctional nanostructured oxidic films and nanopowders based on high k dielectric pure and doped CeO_2



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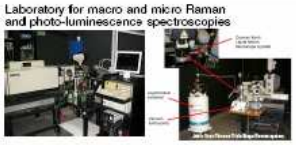
Center for Solid State Physics and New Materials

Laboratory for crystal growth and sample preparation

Laboratory for macro and micro Raman and photo-luminescence spectroscopies



Laboratory for galvano-optic and galvano - magnetic measurements

Laboratory for nanoscopy

Laboratory for Furier transform infrared spectroscopy, ellipsometry and Brillouin spectroscopy

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Multifunctional nanostructured oxidic films and nanopowders based on high k dielectric pure and doped CeO_2

The synthesis and investigation of the structural, electronic and optical properties of so-called "high-κ" dielectric materials in the form of nanocrystals and thin films.

Applications:

(1) In second generation of spintronics

(2) attractive material for ultra-thin gate oxide in CMOS technology,

(3) gate insulators in organic thin-film transistors (OTFTs),

(4) material for resistive oxygen sensors and as a capacitor dielectric in dynamic random access memories (DRAMs), and

(5) electrolyte material for intermediate temperature solid oxide fuel cells (ITSOFCs).

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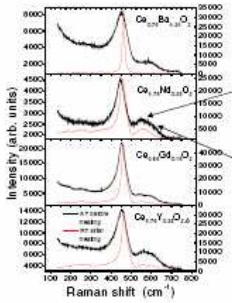
Raman spectra of doped CeO_2



The incorporation of metal cations to the ceria lattice can induce plenty of oxygen vacancies.

Oxygen vibration mode due to the vacancies introduced into the ceria lattice whenever Ce^{4+} ions are replaced with trivalent (divalent) cations. Thus, the material can absorb and give off oxygen easily and enhances oxygen storage capacity.

Oxygen vibration mode due to the nonstoichiometry of undoped ceria nanopowders.

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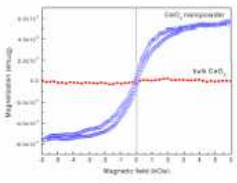
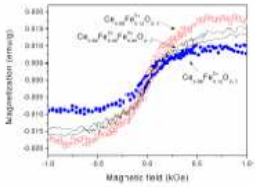
Room temperature ferromagnetism in pure and Fe doped CeO_2 nanocrystals





❖RT-FM in pure CeO_2 nanocrystalline powder has given a strong evidence of oxygen vacancy induced ferromagnetic ordering in this nonmagnetic oxide, so called **F-center exchange mechanism.**

RT-FM in Fe doped samples originates from a combination effect of oxygen vacancies and TM doping **and is almost three times higher than in pure ceria.**

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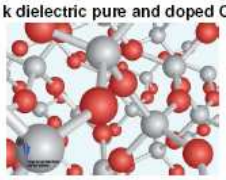

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