

Actinides and Rare Earths Focus Topic

Room Hall B - Session AC-ThP

Actinides and Rare Earths Poster Session

Moderators: David Shuh, Lawrence Berkeley National Laboratory, James Tobin, UW Oshkosh

AC-ThP-1 Upconversion Photoluminescence Efficiency Dependence of Yb ions in Gd_{0.91-x}NbO₄: Yb₃₊, Er_{0.09}, S Yi, *Seung Gon Lee*, Silla University, Republic of Korea

Gd_(0.91-x)NbO₄: Er³⁺_{0.09}, Yb³⁺_x (x= 0.03, 0.06, 0.09, 0.12 and 0.15) phosphors were synthesized by the facile solid state reaction method. Yb³⁺ concentrations were changed from 0.03 to 0.15 mol for the fixed Er³⁺ concentration at 0.09 mol. The particle size of phosphors was around 180 ~ 350 nm and shape were angular oval observed by scanning electron microscopy. The crystalline structures of the phosphors were investigated by X-ray diffraction. The photoluminescence emission based on the green emissions near 528 and 551 nm and red emissions near 657 and 675 nm were observed and the highest emission intensity occurred for the sample Yb_{0.15}Er_{0.09}. Also, under the 980 nm excitation, Er³⁺, Yb³⁺ co-doped GdNbO₄ phosphors appeared the up-conversion emission based on the green emission near 535 nm and 556 nm radiated by ²H_{11/2} → ⁴I_{15/2} and ⁴S_{3/2} → ⁴I_{15/2} transitions and red emission about 657 nm and 675 nm radiated by ⁴F_{9/2} → ⁴I_{15/2} transition, which assigned to the intra 4f transitions of Er³⁺ ions.

AC-ThP-2 Luminescence Characteristics of (Gd_{0.85-x}Yb_{0.15})NbO₄:Er³⁺ Phosphors, S Yi, *DongGyu Lee*, Silla University, Republic of Korea

Gd_(0.85-x)NbO₄: Yb³⁺_{0.15}, Er³⁺_x (x= 0.03, 0.06, 0.09, 0.12 and 0.15) phosphors were synthesized by the solid state reaction method. Er³⁺ concentrations were changed from 0.03 to 0.15 mol for the fixed Yb³⁺ concentration at 0.15 mol. The crystalline structures of the phosphors were investigated by X-ray diffraction. The particle size of phosphors was around 140 ~ 320 nm and shape were angular oval observed by scanning electron microscopy. The photoluminescence emission based on the blue emission near 471 nm, green emission near 596 nm and red emission near 621 nm were observed and the highest emission intensity occurred for the sample Yb_{0.15}Er_{0.09}. Also, under the 980 nm excitation, Er³⁺, Yb³⁺ co-doped GdNbO₄ phosphors appeared the up-conversion emission based on the green emission near 535 nm and 556 nm radiated by ²H_{11/2} → ⁴I_{15/2} and ⁴S_{3/2} → ⁴I_{15/2} transitions and red emission about 657 nm and 675 nm radiated by ⁴F_{9/2} → ⁴I_{15/2} transition, which assigned to the intra 4f transitions of Er³⁺ ions.

AC-ThP-3 Exploring the Electronic Structure of Molecular Lanthanide Complexes in the +2 Oxidation State Using Photoelectron Spectroscopy, *Daniel Huh, J Bruce, J Hemminger, W Evans*, University of California, Irvine

Recent advances in rare-earth metal reduction chemistry have led to the isolation of a new series of Ln(II) complexes. For Ln = Y, La, Ce, Nd, Gd, Tb, Dy, Ho, Er, and Lu, reduction of 4fⁿ (C₅H₄SiMe₃)₃Ln^{III} complexes generates [(C₅H₄SiMe₃)₃Ln^{II}]⁻ products that exhibit unusual 4fⁿ5d¹ mixed-principal quantum number electron configurations. X-ray photoelectron spectroscopy (XPS) has been employed to examine and compare these mixed-principal quantum number electronic structures with those of traditional Ln(II) complexes that have 4fⁿ⁺¹ configurations. In this work, X-ray and ultraviolet photoelectron spectroscopy have been used to examine the electronic structure of [K(2.2.2-cryptand)][(C₅H₄SiMe₃)₃Ln^{II}] (Ln = Eu, Gd, Tb) where Gd(II) and Tb(II) have previously been shown to have non-traditional 4f⁷5d¹ and 4f⁸5d¹ electronic configurations, respectively, and where Eu(II) has been shown to have a traditional 4f⁷ electronic configuration.

AC-ThP-4 Effects of Cerium Content on Local Structure in U_{1-x}Ce_xO₂ Solid Solution, *H Cao*, Shanghai Institute of Applied Physics, Chinese Academy of Science, China; *Yuying Huang*, Shanghai Institute of Applied Physics, Chinese Academy of Science, China

Uranium–cerium mixed oxides U_{1-x}Ce_xO₂ (x=0.05, 0.20, 0.35, 0.50, 0.65, 0.80) were prepared by co-precipitation method. X-ray diffraction data shows that the U_{1-x}Ce_xO₂ samples are solid solutions with lattice parameters following Vegard's law. The local structures of U_{1-x}Ce_xO₂ were studied by X-ray absorption fine structure spectroscopy at both U L₃ and Ce K edges. To avoid the interference from L₂ edge in Ce edge XAFS data, Ce K edge XAFS was used to obtain more accurate local structure of Ce. XAFS data shows that there is local structure disorder in U_{1-x}Ce_xO₂ solid solution. The effects of Ce content on the local structure disorder in U_{1-x}Ce_xO₂ solid

solution were studied. For a cerium content less or equal to about 35%, the disorder increases with the addition of cerium in the U_{1-x}Ce_xO₂ solid solution. When the cerium content increases to more than 50% the disorder of the sample decreases rapidly.

AC-ThP-5 Magnetism of the (Nd,R)₂Fe₁₄B - H system with R = Er and Tm, *I Tereshina, Lev Ivanov*, M.V. Lomonosov Moscow State University, Russian Federation; *D Gorbunov*, Helmholtz-Zentrum Dresden-Rossendorf, Germany; *M Paukov*, Charles University, Prague, Czech Republic; *E Tereshina-Chitrova*, Institute of Physics, Academy of Sciences of the Czech Republic, Czech Republic; *M Doerr*, Technische Universität Dresden, Germany; *L Havela*, Charles University, Prague, Czech Republic; *A Andreev*, Institute of Physics ASCR, Czech Republic

Since the discovery in 1984, the R₂Fe₁₄B (R is a rare earth) compounds received a considerable scientific attention due to their hard magnetic properties [1,2]. Fundamental characteristics of the best permanent magnet Nd₂Fe₁₄B are known to be highly sensitive to the atomic substitutions and absorbed light atoms such as hydrogen. In the present work, we studied a combined influence of substitutions of Er and Tm for Nd and hydrogen absorption on the behavior of magnetization in magnetic fields up to 60 T. All studies were conducted on free powder samples at 2 K.

It is found that the substitution in the rare earth sublattice decreases the saturation magnetization as a result of ferrimagnetic ordering of magnetic moments of heavy rare earths with respect to the moments of Nd and Fe. However, under sufficiently strong magnetic fields the magnetic moments rotate and in the ideal case, the field-induced ferromagnetic state is observed. This phenomenon is directly connected to the strength of the inter-sublattice exchange interactions (Fe and Nd, Er, Tm sublattices).

In the parent materials (Nd_{0.5}Er_{0.5})₂Fe₁₄B and (Nd_{0.5}Tm_{0.5})₂Fe₁₄B in fields up to 60 T no increase of the magnetization was observed. Hydriding of the compounds up to the maximum possible hydrogen content 5.5 at.H/f.u. allows us to observe a forced-ferromagnetic state in the (Nd_{0.5}Tm_{0.5})₂Fe₁₄BH_{5.5} compound. The transition from ferri- to the ferromagnetic state occurs gradually: it begins at the 35 T field and finishes at 55 T. For the compound (Nd_{0.5}Er_{0.5})₂Fe₁₄BH_{5.5} we also observe a magnetization increase. So that, hydrogenation is found to weaken the intersublattice exchange interaction in these three-sublattice materials.

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[1] J. F. Herbst, Rev. Mod. Phys. 63, 819 (1991).

[2] O. Gutfleisch et al. Advanced Mater. 23 (7), 821 (2011).

Author Index

Bold page numbers indicate presenter

— A —

Andreev, A: AC-ThP-5, **1**

— B —

Bruce, J: AC-ThP-3, **1**

— C —

Cao, H: AC-ThP-4, **1**

— D —

Doerr, M: AC-ThP-5, **1**

— E —

Evans, W: AC-ThP-3, **1**

— G —

Gorbunov, D: AC-ThP-5, **1**

— H —

Havela, L: AC-ThP-5, **1**

Hemminger, J: AC-ThP-3, **1**

Huang, Y: AC-ThP-4, **1**

Huh, D: AC-ThP-3, **1**

— I —

Ivanov, L: AC-ThP-5, **1**

— L —

Lee, D: AC-ThP-2, **1**

Lee, S: AC-ThP-1, **1**

— P —

Paukov, M: AC-ThP-5, **1**

— T —

Tereshina, I: AC-ThP-5, **1**

Tereshina-Chitrova, E: AC-ThP-5, **1**

— Y —

Yi, S: AC-ThP-1, **1**; AC-ThP-2, **1**