HYDROTHERMAL TECHNOLOGY FOR THE GREEN SYNTHESIS OF RARE EARTHS DOPED ZIRCONIA NANOPARTICLES

Adrian Mihail Motoc1, Anca Elena Slobozeanu1*, Simona Elena Bejan1*, Radu Robert Pitecescu1*, Dumitra Valentin Dragut1, Alain Largeteau2 and Mythili Prakasam2*
*corresponding authors: a.slobozeanu@imnr.ro; bejian@imnr.ro; pitecescu@imnr.ro; mythili.prakasam@u-bordeaux.fr
1National R&D Institute for Non-Ferrous and Rare Metals, INCDMNR-IMNR, 102 Biruintei Blvd, 077145, Pantelimon, Ilfov, Romania
2CNRS, Univ. Bordeaux, ICMCB, UMR 5026, 87 avenue du Dr A. Schweitzer, 33608 Pessac, France

Abstract:
Here we present the results on the hydrothermal synthesis of nanocrystalline zirconia materials doped with controlled amounts of one or more different rare earth oxides such as La, Y, Gd, Nd and Sm. A thermodynamic prediction software is used to select the temperature, pH and concentration for process optimization. XRD analysis of nanopowders obtained at different temperatures is used to evaluate the crystal lattice parameters, crystalline sizes and phase composition. The effect of doping zirconia with multiple rare earth oxides on the thermal stability of nanomaterials is discussed.

Background:
Monazite
(Ce, La, Nd, Th, Y, Dy, Sm)(PO₄)

Concentration and separation in individual REs:
high cost process
complex process
large quantities of chemical reagents
waste gas, waste water, solid waste
large number of extraction cycles

Methods and Results
Hydrothermal synthesis
Solution of lanthanide oxides
ZrCl₄ solution
Hot mixing with stirring
Doped solution
Hydrothermal treatment
Berghof autoclave (T, P, t)
Filtration
Three-stage washing
Drying
Dry ceramic powder

Acknowledgement: This research was funded by H2020 ERAMIN II Programme, MONAMIX project ID 87, financed in the frame of grant 50/2018 UEFISCDI Romania, Ctr. ANR-17-MIN2-0003-03 France and Ctr. MIUR 8361/05 May 2017-CUP a. B86G17000750001 Italy and project PN 19 19 04 01 financed by Romanian Ministry for Education and Research.

Conclusions
Present research is expected to impact high tech applications of REOs.