

Using Rutherford Backscattering Spectroscopy to Investigate ErF₃ Doped CaF₂ Samples

P.L. Tuan^{1,2,*}, M. Kulik³, M. Stef⁴, T.V. Phuc^{5,6}, N.T.B. My^{1,7}, N.N. Anh^{8,9},
T.Y. Zelenyak¹, G. Buse⁴, A. Racu⁴, A. Doroshkevich¹, L.H. Khiem^{5,6}, V.D. Cong^{1,5}

¹Frank Laboratory of Neutron Physics, Joint Institute of Nuclear Research, Dubna, 141980, Russia;

²Hanoi Irradiation Center, Vietnam Atomic Energy Institute, Hanoi, 129000, Viet Nam;

³Institute of Physics, Maria Curie-Skłodowska University, Pl. Marii Curie-Skłodowskiej 1, 20-031 Lublin, Poland;

⁴Faculty of Physics, West University of Timisoara, 300223 Timisoara, Romania;

⁵Institute of Physics, Vietnam Academy of Science and Technology, 10 Dao Tan, Ba Dinh, Hanoi, 118500, Viet Nam;

⁶Graduate University for Science and Technology, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet, Cau Giay, Hanoi, 122100, Viet Nam;

⁷Institute for Nuclear Science and Technology, Vietnam Atomic Energy Institute, Hanoi, 122100, Viet Nam;

⁸Faculty of Fundamental Science, PHENIKAA University, Yen Nghia, Ha Dong, Hanoi 12116, Viet Nam;

⁹PHENIKAA Research and Technology Institute (PRATI), A&A Green Phoenix Group JSC, No.167 Hoang Ngan, Trung Hoa, Cau Giay, Hanoi 11313, Viet Nam

Using the vertical Bridgman method, we grow ErF₃ doped calcium fluoride (CaF₂) crystals with various concentrations. These samples are investigated using the Rutherford backscattering spectroscopy (RBS) method, which determines the depth profile of Ca, F, and Er (Fig. 1). The obtained results allow us to identify the correlated changes in the concentration of element of the crystals as Er³⁺ ions are doping. In addition, we build several trial models using the SIMNRA computer code to simulate the RBS spectra of all the investigated samples with different incident angle. Because the simulated spectra agree well with the experimental spectra, we can use these models to determine the depth profile of elements obtained directly from the RBS experiment spectra, the homogeneity of samples, and the possibility of layer porosity in ErF₃ doped CaF₂ crystals, where the concentration of Er may also play an important part (Fig. 2).

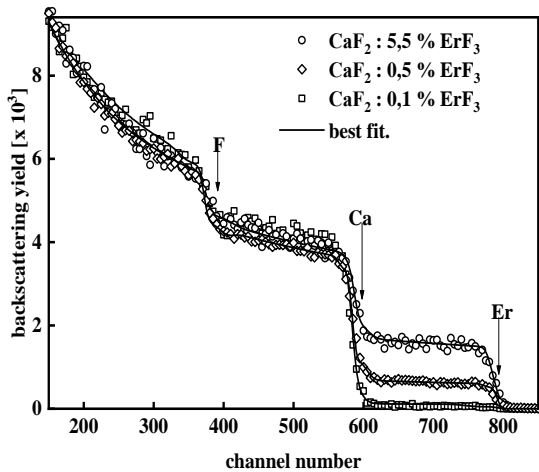


Fig. 1

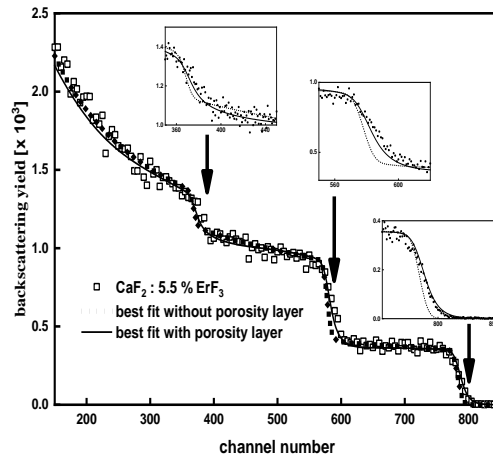


Fig. 2

Keywords: calcium fluoride; RBS; ErF₃; depth profile; porosity

*Corresponding author: phanluongtuan@gmail.com