
A study on possible gamma ray interferences from ^{60}mCo , ^{139}Ba and ^{56}Mn formed in the direct thermal neutron irradiation of $\text{LaBaCo}_2\text{O}_6$ e $\text{LaBaMn}_2\text{O}_6$ perovskites to produce $^{140}\text{La}(^{140}\text{Ce})$ probe nuclei for PAC spectroscopy

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In this work, a method to introduce radioactive ^{140}La nuclei with a half-life ($t_{1/2}$) of 40.8 h, into samples of $\text{LaBaTM}_2\text{O}_6$ (TM = Mn, Co) double perovskites is described to carry out perturbed gamma-gamma angular correlation (PAC) spectroscopy measurements using $^{140}\text{La}(^{140}\text{Ce})$ as probe nuclei. There are several methods to insert this probe nucleus in the samples and the present paper presents a new methodology to obtain the $^{140}\text{La}(^{140}\text{Ce})$ in the compounds. These compounds were submitted to short irradiations with thermal neutrons in the rabbit station of IEA-R1 nuclear reactor of the IPEN/CNEN-SP. This method could be used because natural La is present in samples. Natural La contains the ^{139}La isotope which, when irradiated with neutrons produces the ^{140}La radioisotope, the parent radioisotope of ^{140}Ce used for PAC measurements. However, other elements present in the compounds are also activated, in particular the isotopes ^{56}Mn , ^{139}Ba and ^{60}mCo . In order to verify if these radioisotopes are presents in the PAC measurements, the gamma ray spectra of these irradiated samples can be measured at different decays times using a high resolution HPGe spectrometer. Samples were irradiated with thermal neutrons for 3 minutes. After short irradiation, the gamma ray spectra were acquired, one hour, 18 h, 24 h and 48 h after irradiation. The gamma ray energies of 328.8 keV and 487.0 keV of ^{140}La (measured in the PAC spectroscopy) can be identified. Besides this, gamma-rays peaks of ^{56}Mn (E_γ of 847.3 and 1812.9 keV and $t_{1/2}$ of 2.57 h), ^{139}Ba (E_γ of 166.04 keV and $t_{1/2}$ of 84.63 min) and ^{60}mCo (E_γ of 58.75 and 1333.30 keV and $t_{1/2}$ of 10.47 min) are identified too. The results indicate that PAC measurements can be started after at least 48 h of decay time when there is in interference of other radioisotopes.

Determination of gadolinium and erbium in Gd_2O_3 and Er_2O_3 nanoparticle samples by neutron activation analysis