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DISINTEGRATION RATE AND GAMMA-RAY EMISSION PROBABILITY PER DECAY MEASUREMENT OF Cu-64

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This work aims to present the ^{64}Cu standardization method developed in the Nuclear Metrology Laboratory (LMN) at the IPEN-CNEN/SP, using a $4\pi\beta - \gamma$ coincidence system, and the measurement of the gamma-ray emission probabilities per decay of 1345.7 keV of ^{64}Cu by means of a REGe gamma-ray spectrometer. The $4\pi\beta - \gamma$ coincidence system consists of a gas- flow proportional counter with 4π geometry and using 90% Ar + 10% CH_4 gas at 0.1 MPa, as the β detector, coupled to two NaI(Tl) crystal for the gamma-ray emission detection. The events were registered by means of a Time to Amplitude Converter (TAC) associated with a Multi-Channel Analyzer. Two gamma-ray windows were set for the coincidence measurements, one including the positron-annihilation quanta and the other located at the total absorption energy peak of the 1345.7 keV gamma-ray transition. The ^{64}Cu was obtained by irradiating 0.3mg of metallic cooper in the IEA-R1 research reactor under a 1×10^{13} cm^{-2} s^{-1} thermal neutrons flux. To obtain the ^{64}Cu solution the foil irradiated was dissolved in 20μL of HNO_3 65% and after that was diluted in 20 mL of 0.1M HCl. The activity was determined by means of the extrapolation curve from eight irradiations, normalized by means of the germanium measurements. The Kawada factor to correct the inefficiency for beta plus and beta minus in the $N_{4\pi}$ has been applied. The gamma-ray full efficiency peak curve of the germanium spectrometer was measured at 17.9 cm of source-detector distance, in the energy range from 244 keV to 2754 keV, by measuring flamed-sealed ampoules of ^{24}Na, ^{60}Co, ^{133}Ba, ^{137}Cs, and ^{152}Eu standardized at the LMN. The sample for measurement in the spectrometer was prepared in flame-sealed ampoule with 1 mL of the diluted solution. The gamma-ray emission probability per decay of the 1345.7 keV transition of 64 Cu was (0.472 $\pm$ 0.010)%, in agreement with the literature.

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