Abstract

Production cross sections of $^{nat}Ni(d,x)^{56,57}Ni$, $^{55,56,57,58}Co$, $^{52,54}Mn$, ^{51}Cr nuclear reactions up to 40 MeV, and of $^{nat}Ni(p,x)^{60,61}Cu$, $^{56,57}Ni$, $^{55,56,57,58}Co$ nuclear reactions up to 65 MeV, were measured by using the stacked-foil activation technique in combination with high resolution γ-ray spectrometry. The results were compared with the available literature values, predictions of the nuclear reaction model codes ALICE-IPPE, TALYS-1.4, and extracted data from the TENDL-2012 library. The new measured data removed some discrepancies and the nuclear model calculations were found to reproduce the experimental data only with partial success. Spline fits were made on the basis of selected data, from which physical yields were calculated and compared with the literature values. In the case of deuteron, the thick target yield was also directly measured and compared with the theoretical value. The applicability of the $^{nat}Ni(d,x)^{56,57,58}Co$ and $^{nat}Ni(p,x)^{57}Ni$, ^{57}Co reaction products for thin layer activation (TLA) was investigated. The production rate of ^{55}Co was compared for proton and deuteron induced reactions on Ni. The excitation functions of the $^{54}Fe(d,n)^{55}Co$, $^{56}Fe(p,2n)^{55}Co$ and $^{58}Ni(p,\alpha)^{55}Co$ reactions were analyzed with relevance to the production of the β^{+}-emitter ^{55}Co ($T_{½}$ = 17.53 h), a promising cobalt radionuclide for positron emission tomography (PET). The nuclear model codes ALICE-IPPE, EMPIRE and TALYS were used to check the consistency of the experimental data of those three production reactions. The statistically fitted excitation functions were employed to calculate the integral yields. The amounts of the impurities ^{56}Co and ^{57}Co were assessed. The significance of nuclear data in production of high-purity radionuclides is discussed.