

# Radiochemical Studies of Fast Neutron Induced Long-Lived Activation Products

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## Aims

The aims of the research agreement were defined as:

- Measurement of  $^{63}\text{Cu}(n,p)^{63}\text{Ni}$ ,  $^{151}\text{Eu}(n,2n)^{150}\text{Eu}$  and  $^{159}\text{Tb}(n,2n)^{158}\text{Tb}$  reaction cross sections in the neutron energy range from threshold to 10.6 MeV
- Hauser-Feshbach calculations

## Status Report

Experimental investigations on the three processes mentioned have been under way for over a year. Irradiations have been done with quasi-monoenergetic neutrons produced via the  $^2\text{H}(d,n)^3\text{He}$  reaction in a  $\text{D}_2$  gas target at our variable energy compact cyclotron CV28. The neutron flux densities have been determined via the  $^{27}\text{Al}(n,\alpha)^{24}\text{Na}$  monitor reaction.

In the case of the  $^{63}\text{Cu}(n,p)^{63}\text{Ni}$  reaction a 60 g compact piece of Cu was irradiated with 7.5 MeV neutrons for 25 h. A chemical separation of the weak  $\beta^-$  emitting  $^{63}\text{Ni}$  ( $T_{1/2} = 100$  y;  $\beta^- = 100$  %;  $E_{\beta^-} = 66$  keV) is envisaged and the radioactivity will be measured either using anticoincidence low-level  $\beta^-$  counting or via scintillation counting. If the techniques are successful, measurements will be done also with 8.5 and 10.5 MeV neutrons.

For studying the  $^{151}\text{Eu}(n,2n)^{150}\text{Eu}$  reaction irradiations have been done at  $E_n = 9.6, 10.1$  and  $10.6$  MeV, each for 8 h. The product  $^{150}\text{Eu}$  ( $T_{1/2} = 35.8$  y;  $EC = 100$  %;  $E_\gamma = 334$  keV;  $I_\gamma = 94$  %) has been identified and quantitative  $\gamma$ -ray spectroscopic analysis is in progress.

For investigations on the  $^{159}\text{Tb}(n,2n)^{158}\text{Tb}$  reaction, three irradiations with neutrons of energies 9.6, 10.1 and 10.6 MeV have been done. The product  $^{159}\text{Tb}$  ( $T_{1/2} = 180$  y;  $EC = 82$  %;  $\beta^- = 18$  %;  $E_\gamma = 944$  keV;  $I_\gamma = 43$  %) has been definitely identified. A quantitative  $\gamma$ -ray spectroscopic analysis will be soon initiated.

Hauser-Feshbach calculations on the excitation functions of the three reactions will be performed in due course of time.