Recent Activities for MA Cross-Section Measurements

Shoji NAKAMURA*[1)], Masayuki OHTA [1)], Hideo HARADA [1)],

Toshiyuki FUJII [2)] and Hajimu YAMANA [2)]

1) Japan Atomic Energy Agency, 2-4 Shirane, Shirakata, Tokai-mura, Naka-gun, Ibaraki-ken 319-1195

2) Kyoto University Research Reactor Institute, Kumatori-cho Sennan-gun, Osaka 590-0494

*E-mail: nakamura.shoji@jaea.go.jp

The social acceptability of nuclear power reactors is related to the waste management of long-lived fission products (LLFPs) and minor actinides (MAs) existing in spent nuclear fuels. The MAs (^{237}Np, ^{241}Am, ^{243}Am) are important in the nuclear waste management, because the presence of these nuclides induces long-term radiotoxicity because of their extremely long half-lives. **Figure 1** illustrates the section of the chart of the nuclides displaying the relevant reactions and decays. Neptunium-237 is one of the most important MAs because of its relatively large abundance in spent nuclear fuels of nuclear power reactors. As seen in Fig.1, ^{237}Np is one of the nuclides that contribute to the breeding of ^{239}Pu. Neptunium-238 also participates in the process. The Am isotopes generate the higher actinides as the Cm isotopes through neutron capture reactions. Since ^{242}Cm generated by the ^{241}Am(n,γ) reaction has a relatively short half-life, the presence of ^{242}Cm induces a problem of decay-heat in the reprocessing of spent nuclear fuels.

The transmutation is one of the solutions to reduce the radiotoxicity of nuclear wastes. In the transmutation study of MAs, the accurate data of neutron capture cross-sections are necessary to evaluate reaction rates by reactor neutrons. In this view point, the cross-section measurements have been made by an activation method. However, there are discrepancies among the reported data for the thermal-neutron capture cross-sections for these nuclides. The discrepancies reach to10 - 20%. Therefore, our concern was focused to measure the cross-sections for these MAs. In the session, our recent activities, particularly for cross-section measurements of MAs (See **Table 1**), will be reported together with the details of experiments. Furthermore, a news flash for cross-sections of LLFPs will be presented on this occasion.

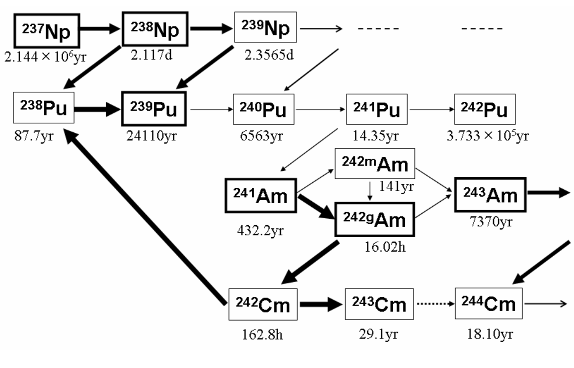

Fig. 1 The section of the chart of the nuclides

Table 1 Recent results for MA cross-sections

Nuclide	Half-life	Past Data (Author, Year)	JAEA Data
^{237}Np	2.14×10^{6} yr	$\sigma_0 = 158\pm3$ b $I_0 = 652\pm24$ b (Kobayashi 1994) $\sigma_0 = 180\pm5$ b (Letourneau 2004)	$\sigma_0 = 141.7\pm5.4$ b $I_0 = 862\pm51$ b (2003) [1] $\sigma_0 = 169\pm6$ b (2006) [2]
^{238}Np	2.1 day	No Data !	$\sigma_{eff} = 479\pm24$ b (2004) [3]
^{243}Am	7370 yr	$\sigma_{0m} = 80$ b, $\sigma_{0g} = 4.3$ b $\sigma_{0m+g} = 84.3$ b (Ice 1966)	$\sigma_{eff} = 174.0\pm5.3$ b (2006) [4]
^{241}Am	432 yr	$\sigma_{0g} = 768\pm58$ b $I_{0g} = 1694\pm146$ b (Shinohara 1997)	$\sigma_{0g} = 628\pm22$ b $I_{0g} = 3.9\pm0.3$ kb (Tentative) [5]

[1] Katoh *et al.*, *JNST*, **40**, 559(2003). [2] Harada *et al.*, *JNST*, **43**, 1289(2006). [3] Harada *et al.*, *JNST*, **41**, 1(2004).

[4] Ohta *et al.*, *JNST*, **43**, 1441(2006). [5] Nakamura *et al.*, *JNST*, to be submitted.