Analysis of Fission with Selective Channel Scission Model

Masayuki OHTA and Shoji NAKAMURA
Japan Atomic Energy Agency
Tokai-mura, Naka-gun, Ibaraki, 319-1195, Japan
e-mail: ohta.masayuki@jaea.go.jp

The selective channel scission model [1-3] has been proposed to calculate the fission product yield. This model deals with the fission process with each channel. The fission product yield is obtained from the penetrability of the channel-dependent fission barrier. However, the channel-dependent fission barrier has not been calculated theoretically. Therefore the adjustable parameter which is concerned with the elongation and the deformation of the nucleus and the Coulomb potential between two fission fragments has been introduced to obtain the channel-dependent fission barrier. And the correlation between the parameter and the fission modes on the multimodal random-neck rupture model has been shown.

In this work, the mass distributions are calculated on simple assumptions about the channel-dependent fission barriers and potentials. 1) The channel-dependent fission barrier is approximated by the difference between Q-value and the Coulomb potential between two fragments of the channel. This Coulomb potential is estimated at the distance which is the sum of the radii of two fragments at the grand state and the distance of the nuclear interaction, which is 1-2 fm. The deformations of nuclei are reported in some mass evaluations, for example KTUY [4] and FRDM [5]. This assumption is related to fusion as the reversal process, although these processes are not equivalent completely because of the irreversible process such as dissipation which causes neutron emission from the fission fragments. 2) The curvatures of the potential near the saddle point, which are not able to be calculated directly in this analysis, are assumed as constant for all channels for simplicity.

The mass distributions for some fission reactions will be reported in this conference. Also, the relation between the multimodal random-neck rupture model and the shape elongation calculated in this work will be discussed.

References

[1] A. Takahashi et al., Jpn. J. Appl. Phys., 40 (2001) 7031.
[2] M. Ohta et al., Jpn. J. Appl. Phys., 40 (2001) 7047.
[3] M. Ohta et al., Jpn. J. Appl. Phys., 42 (2003) 645.
[4] H. Koura et al., Nucl. Phys. A, 674 (2000) 47.
[5] P. Möller et al., Atomic data and Nuclear data Tables, 59 (1995) 185.