[3] C. Schwarz, et al., Phys. Rev., C48(1993)676.
[4] C. B. Chitwood, et al., Phys. Lett., B172(1986)27.
[5] G. J. Kunde, et al., Phys. Lett., B272(1991)202.
[6] W. Trautmann, et al., Phys. Rev., C76(2007)064606.
[7] J. Pochodzalla, et al., Phys. Rev. Lett., 75(1995)1040.

2 - 31 Analysis on Products of Proton-induced Spallation Reactions by INCL+ABLA Model

Han Rui, Chen Zhiqiang, Zhang Suyalatu, Liu Xingquan, Lin Weiping, Jin Zengxue
Liu Jianli and Shi Fudong

Spallation reactions have recently gained considerable interest due to their importance in technical applications. They can be used for the production of neutrons in spallation neutron sources of and act as an intense neutron source an accelerator driven subcritical reactors and so on[1]. The design of an accelerator-driven system (ADS) requires precise knowledge of nuclide production cross sections in order to be able to predict the amount of radioactive isotopes produced inside the spallation target[2]. Therefore the study about products of proton-induced spallation reaction is very important.

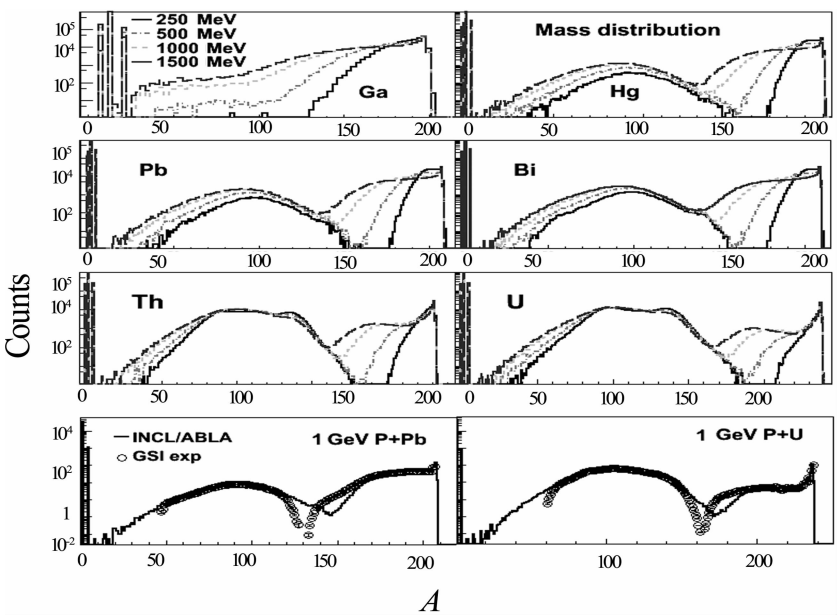

Fig. 1 Mass distributions of spallation product in various targets irradiated by protons with various energies, and the data of Pb and U targets compared with experiment value.

In this work, the spallation products from spallation reaction of spallation target triggered by high energy protons in accelerator-driven system were calculated under different material targets and various energy incident protons respectively using INCL+ABLA model. Then the radiological toxicity of spallation products was studied. In Fig. 1, mass distributions of spallation product in Pb and U targets are agreement with experimental data. And it shows that the calculation with INCL+ABLA model is reliable. From Fig. 2 we can see that the toxicity of spallation producs increase with increasing incident energy and mass number of targets. It reveals that the toxicity of the spallation products is often on high-rate, especially those alpha emitting rate earths caused by the incident proton under the ADS required energy largely contribute into overall toxicity of spallation targets. These nuclides will exert a radiological hazard on the biotic environment, if do not transmute them in the radiant field.

ADS techniques gave access to long-lived residues only, and thus mainly cumulative yields were deter-

mined, resulting from beta decay of the primary reaction products. Indeed, longlived isotopes will increase the long term radiotoxicity of the system. These studies could provide information on the radiation shield designs for accelerators.

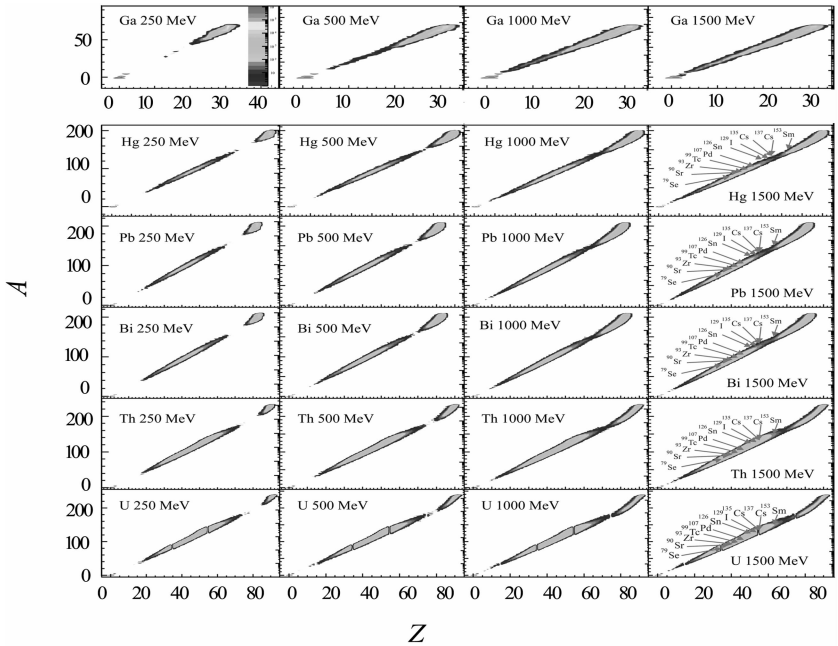

Fig. 2 Z(charge number) vs A(mass number) distributions for proton induced fission and spallation products of various targets.

References

[1] J. Ta eb, et al., Nucl. Phys., A727(2003)413.
[2] W. Wlazło, et al., Phys. Rev., L84(2000)5736.

2 - 32 Kinetic Study of Uranium Biosorption by Calcium Alginate Beads

Bai Jing and Qin Zhi

Calcium alginate (CaAlg) beads are potential biosorbent for radionuclides removal as they contain carboxyl groups. However, until now limited information is available concerning the uptake behavior of uranium by this polymer gel, especially when sorption kinetics is concerned.

The kinetic results of uranium sorption by CaAlg beads at different temperatures are illustrated in Fig. 1. From Fig. 1, it can be observed that fast uranium sorption happened in the first 30 min, then gradually slowed down and reached equilibrium after 70 min. Higher sorption rate at initial period (first 30 min) may be due to an increased concentration gradient between adsorbate in solution and adsorbate in adsorbent surface. This increase in concentration gradient tended to increase uranium sorption rate at the initial stage. As time proceeded, this gradient reduced because of the accumulation of uranium ions in the vacant sites, leading to a decrease in sorption rate at the later stage[1].

Kinetic data obtained under different temperatures were simulated by pseudo-first-order and pseudo-second-order kinetic models. The calculated model parameter values are listed in Table 1.