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Important role of relationship between reaction Q-value and Coulomb barrier height in synthesizing new superheavy elements

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In recent years, the synthesis of new superheavy element (SHE) has been paid attention around the world. When synthesizing SHEs, hot fusion using ^{48}Ca as projectile and actinides as targets is successful for many SHEs up to Og ($Z=118$) [1,2]. In synthesizing SHEs after $Z=119$ by hot fusion, if ^{48}Ca is used as projectile, it is necessary to use nuclides after Es ($Z=99$) as targets. However, nuclides after Es ($Z=99$) have so short half-lives, it is not practical to use them as targets. Therefore, to synthesize SHEs after $Z=119$, it is necessary to use projectile with a higher number of protons than ^{48}Ca . This allows the target to be determined relatively stable nuclide in actinides.

The synthesizing of SHEs includes touching process, formation process, and decay process. We calculate evaporation residue cross section by combining three probabilities of these processes. The touching probability is calculated by coupled-channel method [3,4]. The formation probability of compound nucleus is calculated by dynamical model with Langevin equation [3]. And the survival probability of excited compound nucleus is calculated by statistical model [5]. In this study, we calculated the evaporation residue cross sections using ^{48}Ca and ^{50}Ti , ^{51}V and ^{54}Cr , which have more protons than ^{48}Ca , as projectiles and actinides as targets. And we analyzed the effect of difference in combination of projectiles and targets on cross sections.

We mainly discuss the effects of reaction Q-value and Coulomb barrier height in the evaporation residue cross sections. We use Q-value that depends on the mass tables. And we use Bass model to estimate the Coulomb barrier height. The values of these parameters differ depending on the combinations of nuclei, and these parameters play very important roles in the estimation of the excitation functions of cross sections. In this presentation, better combinations of projectiles and targets in the synthesis of new superheavy elements will be discussed.

References

- [1] Yu. Ts. Oganessian, *et al.*, Phys. Rev. C 70, 064609 (2004).
- [2] Yu. Ts. Oganessian, *et al.*, Phys. Rev. C 74, 044602 (2006).
- [3] Y. Aritomo, *et al.*, Phys. Rev. C 85, 044614 (2012).
- [4] K. Hagino, *et al.*, Computer Physics Communications 123 (1999) 143-152.
- [5] Y. Aritomo, *et al.*, Phys. Rev. C 59, 769, February 1999.

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