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Quasielastic backscattering measurement for ^{51}V + ^{248}Cm reaction toward element-119 synthesis at RIKEN

M. Tanaka[1,2] for nSHE collaboration[1-15]

[1] *Kyushu University, Japan;* [2] *RIKEN Nishina Center for Accelerator-Based Science, Japan;*
[3] *The Australian National University, Australia;* [4] *Institute of Modern Physics, China;*
[5] *Université de Strasbourg, CNRS, IPHC UMR 7178, France;* [6] *Japan Atomic Energy Agency (JAEA), Japan;*
[7] *Joint Institute for Nuclear Physics and Applications (JINPA), USA;* [8] *High Energy Accelerator Research Organization (KEK), Japan;* [9] *Niigata University, Japan;* [10] *Oak Ridge National Laboratory, USA;*
[11] *Osaka University, Japan;* [12] *Saitama University, Japan;* [13] *Tohoku University, Japan;*
[14] *University of Tennessee, Knoxville, Tennessee 37996, USA;* [15] *Yamagata University, Japan*

The periodic table is now completely filled up to the seventh period. The synthesis of elements 119 and 120 has been attempted in several cases using the combination of actinide targets and projectile beams heavier than ^{48}Ca. However, these new elements have not been discovered yet so far.

In the synthesis of superheavy elements, the reaction energy is the most important parameter that significantly affects the experimental efficiency. At RIKEN, element 119 is being searched using a ^{51}V+^{248}Cm hot fusion reaction. The optimal reaction energy of this reaction system is unknown since theoretical predictions vary widely. Under these circumstances, our group has developed a method to estimate the optimal energy from the quasielastic (QE) barrier distribution [1,2].

In our latest study [3], we measured the QE barrier distribution of ^{51}V+^{248}Cm (Fig. 1), using a gas-filled recoil ion separator GARIS-III at a recently upgraded Superconducting RIKEN Heavy Ion LINAC (SRILAC) facility. The energy corresponding to the side collision B_{side}, which is considered to be favorable forming a compound nucleus, was derived from the average barrier height B_0 (Fig. 1(b)), and the optimal reaction energy was estimated based almost purely on experimental evidence. Using the optimal energy obtained in this study, an experiment to synthesize element 119 is currently in progress at RIKEN.

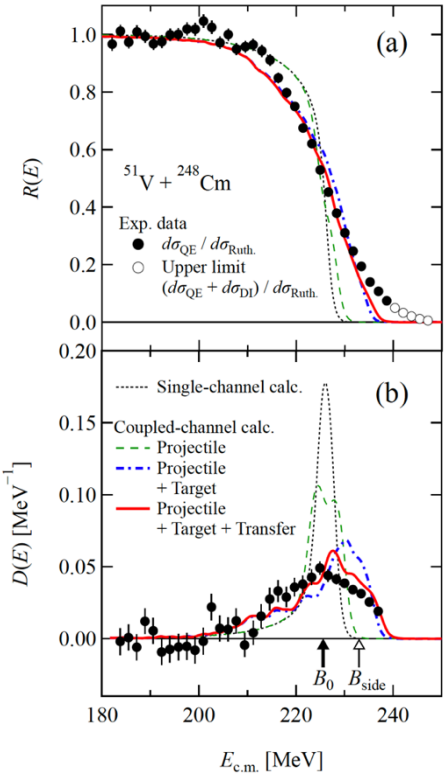

Fig. 1 (a) Excitation function of the QE backscattering cross section relative to the Rutherford cross section for the ^{51}V+^{248}Cm reaction. (b) The QE barrier distribution derived ftom (a).

References

[1] T. Tanaka et al., J. Phys. Soc. Jpn **87**, 014201 (2018).
[2] T. Tanaka et al., Phys. Rev. Lett. **124**, 052502 (2020).
[3] M. Tanaka et al. for nSHE collaboration, submitted.