The Superheavy Element Search Campaigns at TASCA

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Successful experiments on the synthesis of elements with Z=114-118 in ^{48}Ca-induced reactions with actinide targets were first performed at the DGFRS in Dubna [1]. Results for Z=114 (Fl) and Z=116 (Lv) nuclei have been later on confirmed by other groups [2-4].

Using doubly-magic ^{48}Ca for the synthesis of yet heavier elements is not possible due to the lack of sufficient amounts of target materials for elements beyond Cf. Thus, several attempts to produce element 120 in reactions with projectiles beyond ^{48}Ca have been carried out at DGFRS and SHIP [5-7]. The separator TASCA and its detection systems were significantly upgraded since the experiment on ^{288,289}Fl [3] was performed [8]. In the past two years, two experiments on the synthesis of elements beyond Z=118 have been undertaken at TASCA using the reactions ^{50}Ti + ^{249}Bk $\rightarrow$ ^{299}119* and ^{50}Ti + ^{249}Cf $\rightarrow$ ^{299}120*. To verify the performance of the setup, element 117 was also synthesized.

The first attempt to form element 120 at TASCA was performed in August-October 2011. The search for element 119 was performed in two series from April to September 2012. The beam energies from the UNILAC, average initial target thicknesses (*d*) [9], and accumulated beam doses for each reaction are given in Table 1. These values are **preliminary**. Beam doses were deduced from beam current measurements in front of the target. 85% of the beam doses were estimated to be on the target.

Subsequent to the months-long experiments on elements 119 and 120, an experiment on the synthesis of element 117 in reaction ^{48}Ca + ^{249}Bk $\rightarrow$ ^{297}117* was successfully performed. In about one month of experiment time, the Bk target was bombarded by ^{48}Ca ions at three different beam energies. The final data analyses of all these experiments are currently ongoing.

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Table. 1. The parameters of the experiments. For details, see text.

Beam	Target	CN	Date	E_{lab} (MeV)	*d* (μg/cm^2)	Beam dose	Beam dose on target
^{50}Ti	^{249}Cf	^{299}120	25.08-12.10.2011	306	515	1.1·10^{19}	0.9·10^{19}
	^{249}Bk	^{299}119	13.04-03.07.2012 23.07-03.09.2012	300	440	4.2·10^{19}	3.6·10^{19}
^{48}Ca		^{297}117	26.09-09.10.2012	270		0.6·10^{19}	0.5·10^{19}
			09.10-22.10.2012	274		0.5·10^{19}	0.4·10^{19}
			22.10-29.10.2012	268		0.3·10^{19}	0.2·10^{19}