

Operation of the tandem accelerator

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The tandem accelerator (Pelletron 5SDH-2, 1.7 MV max.) (Fig.1) was operated for a total of 84 days for experiments during the annual reporting period from Jan 1 to Dec 31, 2015.



Fig.1 The Pelletron tandem accelerator and beamlines

A total of 20 days were spent on machine inspection, dose measuring, troubleshooting, beam test, and recovery from electric power failure.

The ion species accelerated in this year are H^+ , He^+ , Au^{3+} and Au^{7+} with energies ranging from 1.0 to 7.0 MeV, as summarized in Table 1. So far, the ion species of H, He, Li, B, C, N, O, Si, Ti, Ni, Cu and Au have been accelerated with our accelerator.

Experimental studies on the following subjects were performed, and some of them are still in progress.

- (1) Characterization of chemical vapor deposition (CVD) single crystal diamond semiconductor detector by using heavy ions (5 days)
- (2) Metallic nanoparticle formation by ion irradiation in liquid (24 days)
- (3) Microbeam irradiation of living cells using a glass capillary with a thin lid (32 days)
- (4) Study of $^{10}B(\alpha, p)$ reaction (15 days)
- (5) Study of helium microbeam using tapered glass capillaries (5 days)
- (6) Analyses using elastic scattering (3 days)
 - (a) Rutherford backscattering spectrometry (RBS)
 - (b) Elastic recoil detection analysis (ERDA) of diamond-like carbon (DLC) thin films and polymers for determining hydrogen distribution.

Starting this fiscal year of 2016, the managing laboratory of the tandem accelerator has been switched from Atomic Physics Research Unit to RNC Research Instruments Group.

Table 1 The beam conditions and the experiments conducted in the tandem accelerator

Ion	Energy [MeV]	Beam current [nA]	Experiment	Operation time [days]
$^1H^+$	1.0 – 3.0	0.01 – 50	Irradiation	63
$^4He^+$	1.5 – 2.3	1 – 10	RBS, ERDA	20
$^{197}Au^{3+}$	4.0	0.01 – 1	Irradiation	2
$^{197}Au^{6+}$	7.0	0.01 – 1	Irradiation	2

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