

Development of a new way to measure the thickness of solid hydrogen target by using intermediate to high energy ion beams.

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Background and Purpose : An efficient way to measure the nuclear radii is to measure the reaction cross section between the incident nucleus and the proton target (especially solid hydrogen). Currently, the method of measuring the length of solid hydrogen and multiplying it by the density to obtain the mass thickness is not sufficiently accurate because of the several % uncertainty in the published density of solid hydrogen. Therefore, we have developed a new method to measure the thickness of solid hydrogen with a high accuracy of about 0.several %.

Method : In our new method, the mass thickness is derived directly from the energy loss of the beam passing through solid hydrogen. Since the accuracy of the theoretical calculation of ΔE is not sufficient, the mass thickness cannot be obtained accurately by comparing it with the measured value. Therefore, we devised a method to derive the thickness of solid hydrogen by comparing the energy loss of polyethylene (CH₂) and (C + H), carbon and solid hydrogen, and performed the measurement.

Experiment : We irradiated (¹⁸O, ²⁷Al) with a primary beam of 200-300 MeV/u and a secondary beam near Ni to CH₂ and C + H, respectively, and measured energy loss in the target at HIMAC, QST at Chiba.

Primary author: Mr TAKAYAMA, Gen (Osaka-u)

Presenter: Mr TAKAYAMA, Gen (Osaka-u)

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