

Lifetime Test of Carbon Stripping Foils with 650keV Negative Hydrogen Ion Beams

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Thick carbon stripping foils ($>300\mu\text{g}/\text{cm}^2$) have been used for charge conversion from H^- ions to protons at the 3GeV Rapid Cycling Synchrotron (3GeV-RCS) of the J-PARC: the high intensity proton accelerator complex at Tokai, Ibaraki, Japan. The foil should have a long lifetime with mechanically strong against the severe high temperature of $\sim 1800\text{K}$ due to high-energy deposition by high intensity H^- ion and circulating bunched proton beam irradiations. Thus, conventional carbon stripping foils (CM-foil) are ruptured in a very short time and even a high quality diamond foil (DM-foil) is also broken at around 1800K. Therefore thick carbon stripping foils with high durability even at 1800K are indispensable for high power accelerators. It has been developed the HBC (Hybrid type Boron mixed Carbon) foil by the controlled dc arc discharge method [1]. To perform the comparative study of HBC foil and others, we have been measured the lifetime of several materials for stripping foil. For this purpose, we have recently developed a new irradiation system using a high intensity H^- ion beam from the KEK 650keV Cocksfoot-Walton accelerator. By adjusting the peak intensity and the pulse length of the hydrogen ion beams appropriately, the energy deposition becomes equivalent to that exerted by the incoming H^- and the circulating beams at the injection process of the RCS. Pulsed ($\sim 10\text{mA}_{\text{peak}}$, 25Hz, 300 μsec) or dc ($\sim 1\text{mA}$) H^- ion beam is extracted from a surface-production type multi-cusp H^- ion source. During the ion beam irradiation ($\sim 200\text{hrs}$) on to the carbon foil, the temperature of the beam spot was measured by an electronic infrared pyrometer automatically. The irradiation system and some results from the lifetime test will be reported.

[1] I. Sugai, et. al., Jpn. Appl. Phys. 45 (2006) 8848.