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Study of the Lifetime for Charge Stripper Foils in the 3-GeV RCS of J-PARC

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For the 3GeV Rapid Cycling Synchrotron (RCS) in J-PARC, charge stripper foil is a key technology to keep high operating rate for multi-turn injection of high-power proton synchrotrons. For a charge stripper foil in the RCS, we applied a Hybrid type thick Boron-doped Carbon (HBC: Boron 25%) foil which is produced with the arc-discharge method. The required foil thickness is about 1.5μm (333μg/cm2) corresponding to a conversion efficiency of 99.7% for 400MeV injection from the linac. Actually it has enough toughness to stand high-intensity beam operation less than 500kW. Recently a graphite foil developed by TASC (Technology Research Association for Single Wall Carbon Nanotubes) graphene division in Japan was also tried to adopt as the stripping foil for the beam operation in J-PARC, and it had good performance in the condition of 200kW beam operation. But after the beam operation both foils occurred deformation by the beam damage. So we are worry to be destroyed by the beam hitting in the higher power condition. It is very important toward 1MW beam operation to predict the lifetime of foils. We have investigated by the microscopic analyses such as TEM for damage of foils by the Argon ion irradiation in energy of 300keV of TIARA (Takasaki Ion Accelerators for Advanced Radiation Application). Now we cannot estimate the lifetime of these foils for the 400MeV beam operation from the results of offline foils study in TIARA. In order to evaluate the lifetime of foils quantitatively, we started to obtain Raman spectra of foils irradiated each ion such as H, He and Ar in energy of different energy such as 350keV, 2 and 3 MeV. We will try to predict the lifetime of foils by estimating peaks' shifts of Raman spectra as an indicator corresponding to DPA (Displacement Per Atom) by simulation code PHITS.

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