§22. Influence of Surface High-Z Impurities on Hydrogen Retention in Steels

Lee, H.T., Oya, K., Yakushiji, K. (Osaka Univ.),
Tokitani, M., Sagara, A.

Reduced Activation Ferritic Martensitic (RAFM) steels are the leading candidates for structural materials in a fusion reactor. To minimize the cost and complexity of building and operating a fusion reactor, it has been suggested that bare RAFM steels be used without any armor materials for the blanket. Preferential sputtering leads to accumulation of high Z elements. We examine the effect of high Z elements on hydrogen isotope retention behavior.

Samples were irradiated using HiFIT device at Osaka U. (1 keV, 1×10^{24} m^{-2}) H-only and simultaneous H+He experiments were performed. Temperature was varied between 700~865 K. Ion beam analysis was performed following H-ion irradiation at NIFS (RBS, ERD). Surface morphology a cross sections were determined by FE-SE and FIB, respectively.

Fig 1 shows the cross section of H-only and H+He irradiated samples at 700 and 865 K. It is clear that surface roughness increases drastically between 700 and 865 K. Next, RBS spectra of H-only irradiated sample is shown in Fig. 2. Surface enrichment of Mo and W can be seen. Fig 3 plots the near surface H and W concentrations (raw counts) measured by ERD and RBS, respectively. It is clear that the trends obey opposite temperature dependency. The results will be presented at 29th Symposium on Fusion Technology[1]. RBS and ERD measurements require reduced solid angles to improve resolution. Measurements of samples irradiated at T>865 K are planned. In terms of education, Master and Doctoral students primarily carried out this work.

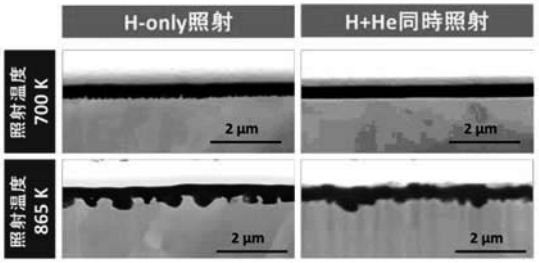

Fig. 1. Cross section images of H-only and H+He irradiated samples at 700 and 865 K.

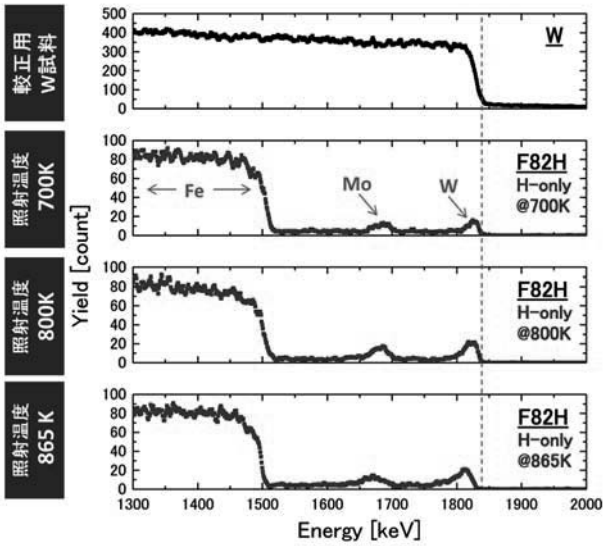

Fig. 2. RBS spectra indicating surface enrichment of Mo and W at the surface following irradiation at various temperatures.

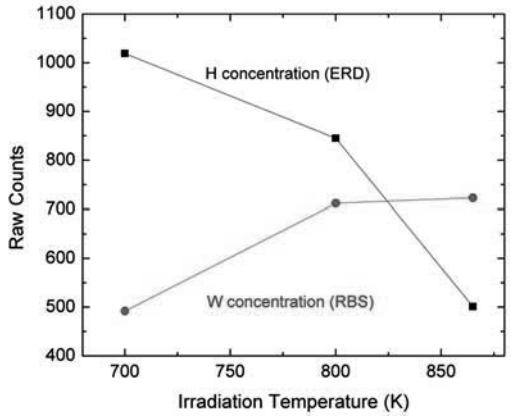

Fig. 3. H and W concentrations (integrated counts) determined from ERD and RBS, respectively.

1) K. Yakushiji, H.T. Lee et al., "Surface erosion and morphology changes of reduced activation ferritic martensitic steel (F82H) under simultaneous hydrogen and heliumirradiation"