It is well known that energetic hydrogen ion irradiation results in blistering and grains exfoliations of materials surface. However, the process and mechanism of these phenomena have not been well understood. Therefore we have been applied tritium radio-luminography, TIP (Tritium Imaging Plate) and TARG (Tritium Auto Radiography) techniques to observe hydrogen distribution and/or accumulation in blisters and surrounding area. TIP is a twodimensional radiation detector having 50 µm² resolution and a high sensitivity for tritium detection. TARG has much higher areal resolution of about 1 µm and can show even tritium accumulation around grain boundary, precipitates, dislocations, and so on.

A sample used here was a Mo sheet. Tritium was loaded by an AC glow discharge method with hydrogen (H) containing tritium (T) with 5x10⁻⁶ in T/H ratio. The sample covered with a stainless plate with a hole of 3mm in diameter was exposed to the glow discharge for long time to appear blisters and their exfoliation on the surface. The irradiated surface was examined by an optical microscope and a scanning electron microscope as well as TIP and TARG.

Because of inhomogeneity of the glow discharge, the surface appearance was divided into two regions, heavily damaged and slightly damaged ones. In the former, not only the flaking of blister skins but also the exfoliation of grains was appreciable, while only blistering accumulated on particular grains in the latter. Correspondingly, tritium distribution given by TIP was separated into two regions. The heavily damaged region contained less tritium compared to the slightly damaged region, indicating hydrogen was released during the flaking of the blister skins and the exfoliation of the grains.

By the film insertion method [1], in which energy of beta-electron was discriminated using thin film, the depth profile of tritium up to a few µm was obtained. It was found that tritium retained near surface area was a little lower at the heavily damaged region than at slightly damaged area, confirming tritium release by the flaking and the exfoliation. Comparing the results of TARG, blistering mechanism will be discussed.

References