Hydrogen Micro-Kinetics in Metals Studied by Application of Ion Beam Analysis

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One of the most important subjects in the fusion material research is to study the hydrogen and helium concentration, diffusion and evolution in the structure material of fusion reactor, since the hydrogen and helium can be continuously produced by the large dose fast neutron irradiation on material. Various analysis methods can be used, but the ion beam analysis method has some advantages for studying the hydrogen behaviors in nano- or micrometer resolution. In this work, the hydrogen three-dimensional distribution in metal has been studied by resonance NRA and micro-ERDA. The resolution of the H-depth-profile is in nanometer level and the lateral resolution can be reached to 2 micrometers. The evolution of hydrogen depth-profile in a titanium sample has been studied versus the change of normal stress. Evident hydrogen diffusion has been observed, while a normal stress is changed in the range of 107–963 MPa. The hydrogen distribution in the interface region of a zirconium sample covered with a chromium electroplating layer has been also studied. The chromium layer may strongly inhibit the hydrogen diffusion. The further study on the hydrogen behaviors in the structure materials of fusion reactor is in plan.

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