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Activation mechanism of surface partially nitrided high-purity titanium deposited film as a nonevaporable getter (NEG) studied by soft X-ray photoelectron spectroscopy (XPS) and angle-resolved hard X-ray photoelectron spectroscopy (HAXPES)

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Recently we found that the surface partially nitrided high-purity Ti deposited film can be activated as a nonevaporable getter (NEG) by heating at 185 ℃. In this study, we investigated the activation mechanism of surface partially nitrided high-purity Ti by using soft X-ray photoelectron spectroscopy (XPS) and angle resolved Hard X-ray Photoelectron Spectroscopy (HAXPES). Both XPS and HAXPES measurements show that most of the surface oxygen atoms diffuse into the Ti bulk by heating at 470 ℃. Based on these results we proposed the following activation mechanism for the surface partially nitrided high-purity Ti film. When heated at 185 ℃, oxygen atoms in the vicinity of the surface nitrogen atoms diffuse into the Ti bulk, creating a narrow path of oxygen deficiency sites along the diffusion route of the oxygen atoms. When returning to room temperature, hydrogen gas is slightly pumped through this oxygen deficiency path. When heated at 450 ℃, most of the surface oxygen atoms diffuse into the Ti bulk, exposing a large area of metallic Ti on the surface. When returning to room temperature, it starts to pump reactive residual gases with high pumping speeds.

Footnotes

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