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Oxygen-Free Pd/Ti Deposition Applied for Soft X-ray Beamline 12A in Photon Factory

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Nonevaporable getter (NEG) is a functional material that is activated by heating under clean ultrahigh vacuum (UHV) conditions and then pumps residual reactive gases at temperatures lower than the activation. Conventional NEGs consist of alloys containing group 4 and 5 metal(s) in the periodic table such as Zr, V, and Ti. During activation, oxygen atoms on the surface oxide layers of the NEG diffuse into the bulk, leaving a reactive surface that is available for absorbing or adsorbing residual gasses such as H2 and CO. When NEG is deposited on the inner wall of a vacuum vessel, the vacuum vessel will evacuate the residual gases just by baking, and UHV can be maintained without electric power for several decades. Therefore, the development of NEGs will contribute to CO2 emission reduction and Sustainable Development Goals (SDGs). In 2001 C. Benvenuti et al. reported that TiZrV thin films deposited by DC magnetron sputtering can be activated by baking at 180 ℃ for 24 h [1]. TiZrV deposition was used with great success at CERN and is now adopted in accelerator facilities around the world. Recently we have developed a new NEG named oxygen-free Pd/Ti [2]. The initial pumping speeds of the oxygen-free Pd/Ti thin film after baking at 150 ℃ were estimated to be 3.2 L s−1 cm−2 for H2 and 7.6 L s−1 cm−2 for CO at room temperature [3]. The oxygen-free Pd/Ti deposition for vacuum chambers and components in soft X-ray beamlines of synchrotron radiation seems to be ideal because it can be partially activated by baking at 75 ℃ for 6 h [3], and its pumping speed does not decrease in the pressure region below 10−8 Pa. In addition, oxygen-free Pd/Ti deposition provides following advantages: 1) Residual hydrocarbon gas becomes CO and CO2 through the catalytic action of Pd and is pumped by a turbo molecular pump, thereby reducing carbon contamination of the optical elements, 2) degassing from the vacuum chamber or components can be reduced, 3) space is not required for the installation of a NEG pump, 4) a dedicated power supply and current feedthroughs are not required, 5) the vacuum chamber or components can be made smaller, and 6) safety and security can be ensured in the event of a power loss. In the present paper we will report on oxygen-free Pd/Ti deposition applied for a new soft X-ray beamline 12A in Photon Factory.

I plan to submit also conference proceedings

Yes

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