Preparation of Iridium Films by Chemical Vapor Deposition on Metal Substrates

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Chemical vapor deposition (CVD) of noble metals has a great significance for practical applications in electronics, protective coating and catalyst industries. The potentiality of applications is due to the valuable combination of the intrinsic properties of these metals, including high thermal/chemical stability, high electrical conductivity and catalytic activity. CVD of iridium (Ir) is of interest to prepare oxidation protective coatings on high-melting-temperature metals such as molybdenum (Mo), tantalum and tungsten. Thus, a great effort has been made in developing viable technologies for CVD of Ir.

Ir coatings were carried out in a cold-wall CVD reactor at atmospheric pressure. Depositions were performed with argon (99.9999%) as a carrier gas and hydrogen (99.999%) as a reducing gas. Mo plates with the size of 30 × 30 × 0.5 mm^3 were used as a metal substrate and the substrate was vertically suspended in the reactor and heated by a high-frequency induction heating. The temperature of the substrate was measured using an infrared thermometer. The flow rate of argon and hydrogen were determined using an electronic mass-flowmeter. An Ir acetylacetonate, $Ir(acac)_3$ precursor used as the source material was heated to maintain a high vapor pressure. After the Mo substrate was heated to 1073-1473 K, the evaporated $Ir(acac)_3$ precursor was transported into the chamber with argon and hydrogen gas and the chamber was evacuated to 200-1000 Pa. After the CVD process the crystal phase of prepared films was identified by X-ray diffraction. It was found that the initial phase of the films was Ir-Mo alloy compound such as Mo_3Ir and $Ir_{1.02}Mo_{0.98}$. It is expected that Ir single phase can be obtained by optimizing the deposition time and thickness. Microstructure was observed with a scanning electron microscope and these results were fed back to the CVD conditions. At the presentation, we will report detailed results of Ir coating and its charactarization.

References

[1] J. R. Vargas Garcia and Takashi Goto, Chemical Vapor Deposition of Iridium, Platinum, Rhodium and Palladium Materials Transactions, 44 No.9 (2003) 1717-1728.
[2] Shirui Yanga, et al., Growth kinetics and microstructure of MOCVD iridium coating from iridium(III) acetylacetonate with hydrogen, Applied Surface Science 329 (2015) 248-255.