C4-P-048001

PREPARATION OF COPPER OXIDE FILMS ON ALUMINA BY A HOT-TARGET HIPIMS PROCESS*

V.YU. LISENKOV[1], A.V. KAZIEV[1], D.V. KOLODKO[1,2], D.G. AGEYCHENKOV[1], A.V. TUMARKIN[1], M.M. KHARKOV[1], M.S. KUKUSHKINA[1]

[1]National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Moscow, Russia
[2]Fryazino Branch of Kotel'nikov Institute of Radio Engineering and Electronics RAS, Fryazino, Russia

One of the basic processes in production of electronic devices is the metallization of dielectric substrates, and particularly, preparation of ceramic print circuit boards (PCBs). There are various methods suitable for applying a conductive copper layer to a dielectric substrate. These include active metal brazing (AMB), cold gas-dynamic spraying (CGS), direct bonded copper (DBC) lamination, and a number of thick-film and thin-film vacuum technologies. The usage of plasma deposition methods for ceramic metallization is limited, mainly due to the relatively low productivity. However, in some applications, for example, when it is necessary to metallize substrates of complex topology, plasma methods might outperform popular mass production technologies in terms of quality and efficiency.

To improve adhesion of comparatively thick (more than 20 μm) magnetron deposited copper coatings, a dedicated intermediate layer of Cu_xO_y can be introduced between the substrate and the film. Here, we report the results of Cu_xO_y deposition on alumina substrates in a hot-target HiPIMS discharge.

The experiments were carried out in a magnetron deposition facility with thermally insulated copper target [1, 2]. To form the discharge, an APEL-M-5HPP-1200 power supply was used. Initially, the magnetron was separated from the substrate by a shutter. In the beginning of the process, the target was heated and melted by a HiPIMS discharge in Ar, at 0.5 Pa pressure. Then desirable O_2 flow was set, while Ar flow was set to zero. The shutter was opened, and the oxide deposition was performed. Cu_xO_y films with thicknesses 1–6 μm were prepared. Their structure was studied with scanning electron microscope, and the composition was measured by EDS and XRD methods. The results showed growth of CuO and Cu_2O films. The correlations between deposition parameters and coating characteristics are discussed.

REFERENCES

[1] A.V. Kaziev, A.V. Tumarkin, K.A. Leonova et al., "Discharge parameters and plasma characterization in a dc magnetron with liquid Cu target," Vacuum, Vol. 156, P. 48–54, 2018.

[2] A.V. Kaziev, D.V. Kolodko, A.V. Tumarkin et al., "Comparison of thermal properties of a hot target magnetron operated in DC and long HIPIMS modes," Surf. Coat. Technol., vol. 409, Article Number 126889, 2021.

* The work was supported by the Russian Science Foundation under grant No. 18-79-10242.