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Metal blacks coating by magnetron sputtering for electron-tube applications

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Functional parts of high-power electron-tubes are exposed to extreme thermal conditions as the transmitted power of such device reaches tens of kW. Most of the excessive irradiated power is absorbed by the surface of the hollow anode, which is the only cooled part of the electron-tube. Therefore the anode surface must be coated with a suitable absorbing material with good electrical conductivity. Metal blacks is well known material absorbing light in visible and infrared spectral range. It is prepared usually by evaporation of suitable noble metal (Au, Pt) in a presence of high gas pressure resulting in the nanostructured morphology that sustain localized optical excitations. High price and very low adhesion are drawback of such metal blacks.
We present deposition of the metal blacks prepared from economically favorable, nanostructured Al, Ti and Ag by means of magnetron sputtering. The hollow copper anode possesses inner diameter of 60 mm. For these experiments, we developed a specialized sputtering system allowing to coat the inner wall of the anode with diameter of 60 mm. The deposition condition were optimized in order to obtain highly nanostructured coating of metal blacks about 1 micrometer thick. The scattered reflectivity was measured by means of a spectrophotometer equipped with an integrating sphere in the spectral range from 200 nm to 3000 nm. The coatings exhibit good omnidirectional absorption indicated by low diffused reflectance ranging from about 6% in visible to about 2% in infrared spectral range. The surface morphology was studied by scanning electron microscope. The electrical conductivity was evaluated. The functionality and thermal resistance of the metal blacks was tested in the functional high-power electron-tube. The operating characteristics of the complete electron-tube was recorded and analyzed.

Keywords
Metal Blacks
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