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Electrical resistivity and structural properties of TiN and ZrN coatings deposited at low temperature

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The resistivity of both TiN and ZrN films can be relatively low, and the coatings may be suitable for robust electrical contacts operating in corrosive environments. Unfortunately, the substrates used for electrical contacts cannot always withstand the high temperatures usually required to make dense and hard TiN and ZrN coatings with low electrical resistivity.

In this work, we have studied the electrical resistivity of TiN and ZrN coatings, sputtered at a low temperature, as a function of the microstructure. HiPIMS, or a combination of HiPIMS and DC sputtering, was used to grow dense coatings with low stress, at a low temperature, similar to recent studies [1,2]. Several depositions were carried out varying substrate bias voltage, N₂ gas flow, average target power, pulse frequency and pulse duration using an industrial CemeCon CC800/9 sputter deposition unit. In all depositions the temperature was at or below 300°C in order not to damage the substrates. The electrical resistivity was measured with a four-point probe setup. Coating hardness was found using nanoindentation, and stress measurements were carried out using Stoneys method. Chemical composition was measured by RBS, while XRD was used to determine the texture and grain size.

References:

[1] M. Lättemann; Thin Solid Films 518, 5978 (2010)

[2] G. Greczynski, et al.; J. Vac. Sci. Tech. A 32, 041515 (2014)

Keywords

TiN

ZrN

HiPIMS

Low temperature deposition

Resistivity