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Properties of TiN thin films grown on SiO₂ by reactive high power impulse magnetron sputtering

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Thin TiN films were grown on SiO₂ by reactive high power impulse magnetron sputtering (HiPIMS) at a range of temperatures from 45 to 600 °C. The film properties were compared to films grown by conventional dc magnetron sputtering (dcMS) at similar conditions [1]. Structural characterization was carried out using X-ray diffraction and reflection methods. The HiPIMS process produces denser films at lower growth temperature than does dcMS. The surface is found to be much smoother for films grown by the HiPIMS process. The [200] grain size increases monotonically with increased growth temperature, whereas the size of the [111] oriented grains decreases to a minimum for a growth temperature of 400 °C after which it starts to increase with growth temperature [2]. The [200] crystallites are smaller than the [111] crystallites for all growth temperatures. The grain sizes of both orientations are smaller in HiPIMS grown films than in dcMS grown films. The mechanical properties, hardness, friction coefficient and Young's modulus were measured and compared. The film resistance was monitored in-situ to determine the coalescence and continuity thicknesses which decrease with increasing growth temperature with a minimum of 0.38 ± 0.05 nm and 1.7 ± 0.2 nm, respectively, at 400 °C. HiPIMS deposited films have a significantly lower resistivity than dc magnetron sputtered (dcMS) films on SiO₂ at all growth temperatures due to reduced grain boundary scattering. [1] A. S. Ingason, F. Magnus, J. S. Agustsson, S. Olafsson, and J. T. Gudmundsson, *Thin Solid Films*, 517 (24) (2009) 6731-6736 [2] F. Magnus, A. S. Ingason, O. B. Sveinsson, S. Olafsson and J. T. Gudmundsson, *Thin Solid Films*, 520(5) (2011) 1621 - 1624

Keywords

Thin films

High power impulse magnetron sputtering

Electrical properties