

## **Layering Methods and Properties of Tantalum Nitride Thin Layers: A Review**

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**Abstract:** Tantalum nitride (TaN) is widely used in mechanical and microelectronic industries due to its unique properties such as high hardness and high electrical resistance as well as stable electrical resistance. Considering its importance in this paper, taking into account the reliable references, a comprehensive review of research developments in the field of layer identification methods, characterization methods, properties and applications of TaN thin films has been carried out. For this purpose, firstly, the production and deposition of these thin layers have been studied by methods such as physical deposition (PVD), DC and RF magnetron sputtering. In addition, the structural, microscopic, electrical, optical, mechanical and tribological properties of thin layers of tantalum nitride have been comprehensively discussed. For this purpose, by analyzing X-ray diffraction patterns, atomic force microscope, scanning electron microscope, calculating the weight of the layers, the effect of changing the nitrogen content of the substrate bias voltage on the residual stress of the layers, changing the hardness and elastic modulus of the tantalum nitride layers with the current ratio Nitrogen, refractive index and extinction coefficient of layers, optical transmission spectrum of layers, electric resistance of layer in different nitrogen flow, surface resistance normalized according to temperature and changes of surface resistance of layers kept at different temperatures have been investigated in detail. The reviewed results show that the produced thin layers have a high potential for application in various fields, especially in harsh environments with high temperature and pressure. This review Article can be a suitable and comprehensive reference for the research that will be done in the field of TaN thin films and related technologies.

**Keywords:** Tantalum Nitride, Implantation, Thin layer, Structural properties.