

Approximation of PE-MOCVD to ALD for TiN Concerning Resistivity and Chemical Composition

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Abstract : The miniaturization of circuits is advancing. During chip manufacturing, structures are filled for example by metal organic chemical vapor deposition (MOCVD). Since this process reaches its limits in case of very high aspect ratios, the use of alternatives such as the atomic layer deposition (ALD) is possible, requiring the extension of existing coating systems. However, it is an unsolved question to what extent MOCVD can achieve results similar as an ALD process. In this context, this work addresses the characterization of a metal organic vapor deposition of titanium nitride. Based on the current state of the art, the film properties coating thickness, sheet resistance, resistivity, stress and chemical composition are considered. The used setting parameters are temperature, plasma gas ratio, plasma power, plasma treatment time, deposition time, deposition pressure, number of cycles and TDMAT flow. The derived process instructions for unstructured wafers and inside a structure with high aspect ratio include lowering the process temperature and increasing the number of cycles, the deposition and the plasma treatment time as well as the plasma gas ratio of hydrogen to nitrogen ($H_2:N_2$). In contrast to the current process configuration, the deposited titanium nitride (TiN) layer is more uniform inside the entire test structure. Consequently, this paper provides approaches to employ the MOCVD for structures with increasing aspect ratios.

Keywords : ALD, high aspect ratio, PE-MOCVD, TiN

Conference Title : ICNNE 2016 : International Conference on Nanoscience, Nanotechnology and Engineering

Conference Location : London, United Kingdom

Conference Dates : September 29-30, 2016