

Reaction Kinetics Study and Properties on TiN Complexes Synthesized at Low Temperature

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Reaction Kinetics and properties on TiN complexes formed with TiCl₄, ammonia as gas sources for TiN thin film deposition processes below 200°C were studied in this work. By understanding the reaction kinetics of the TiN complexes below 200°C we can control and reduce the unwanted TiN complexes formed in the exhaust line and pumping system, which leads to the improvement of productivity in TiN chemical vapor deposition processes. The results showed that the deposition rate increased with increasing the temperature below 200°C and NH₃ flow rate at different process parameters including flow rate of TiCl₄. Through analyzing the distribution of complexes deposition on temperature, the activation energy of deposition reaction below 200°C was almost 10kJ/mol. The reaction order of NH₃ was extracted by the experimental data at fixed TiCl₄ flow rate.

Micro-structural examination by scanning electron microscope revealed the surface morphology was changed with the temperature. Increasing the deposition temperature, the surface' area was increased. Compositional analysis of average reaction complexes below 200°C had the atomic ratios of Ti: 1 N: 5.2 Cl: 4.1 below 200°C which was examined by the energy dispersive spectroscopy (EDS).