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Analysis of titanium species in titanium oxynitride films prepared by plasma enhanced atomic layer deposition

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Abstract

A comparative study of thin titanium oxynitride (TiO_xN_y) films prepared by plasma enhanced atomic layer deposition using tetrakis(dimethylamino)titanium (TDMAT) and N_2 plasma as well as titanium(IV)isopropoxide and NH_3 plasma is reported. The comparison is based on the combination of Ti2p core level and valence band spectroscopy and current-voltage measurements. The TDMAT/ N_2 process delivers generally higher fractions of TiN and TiON within the Ti2p spectra of the films and stronger photoemissions within the bandgap as resolved in detail by high energy resolution synchrotron-based spectroscopy. In particular, it is shown that higher TiN contributions and in-gap emission intensities correlate strongly with increased leakage currents within the films and might be modified by the process parameters and precursor selection.

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