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Dimethylethylamine Alane를 이용한 CVD 알루미늄박막 증착의 수소플라즈마 전처리효과

Hydrogen Plasma Pre-treatment Effect on the Deposition of Aluminum Thin Films from MOCVD Using Dimethylethylamine Alane

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ABSTRACT

The Al-CVD process is interesting because of the possibility of good step coverage and good contact fill. Therefore, it may be necessary to utilize an Al-CVD process, because in CVD-Al all previously known technologies and etch processes can be utilized. DMEAA is a recently introduced member of the amine family and is an adduct of alane (AlH_3) and dimethylethylamine [$N(CH_3)_2C_2H_5$]. It contains no direct Al-C bonds. Therefore, carbon incorporation into the growing film is expected to be very low. DMEAA is also useful because it is a liquid with a relatively high vapor pressure (1.5 Torr) at room temperature and because it is not pyrophoric.. In this study, we have investigated the effect of plasma pre-treatment of substrates on the microstructure and deposition rate of Al films with DMEAA.

To study the effect of pre-treatment of substrates on the deposition behavior of Al thin films, the surfaces of TiN and SiO_2 substrates were exposed to hydrogen plasma or Ar plasma before Al deposition. The Al films were deposited by the pyrolysis of dimethylethylamine alane (DMEAA). A uniform Al film was deposited by the hydrogen plasma exposure to an SiO_2 substrate, while island grains were grown by the Ar plasma exposure. The pre-treatments of a TiN substrate did not affect the deposition rate of the Al film. The concentration of OH radicals at the SiO_2 surface was increased by the hydrogen plasma treatment. The nucleation density of Al deposited on the SiO_2 substrate with H_2 plasma exposure was higher than that of Al deposited on the SiO_2 substrate without plasma pre-treatment. It was found that Si-OH bonds at the SiO_2 surface were increased by H_2 plasma exposure. We suggest a model that the OH radicals enhance the sticking coefficient of the Al source and increase the number of Al nucleation sites.