

FT-IR studies of the aluminum chemical vapor deposition using aluminum Borohydride trimethylamine (ABHTMA)

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The chemical species in gas phase and on the surface of aluminum boro-hydride trimethylamine (ABHTMA) for aluminum CVD process as a function of the hot wall temperature and the chamber pressure were studied using two kinds of Fourier transform infrared (FT-IR) spectrometers installed at the end of the chamber. The absorbance of Al-H, B-H, C-H and C-N stretching features of ligands in ABHTMA in the gas phase and on the surface was sensitive to the variation of analysis conditions. The area ratio of integrated absorbance of Al-H and B-H stretching features located at the different position could estimate the dissociation rate of the ABHTMA, which was abruptly changed in the range of 140 ~ 160°C. With the results, the temperature dependence of the film composition and quality could be explained. Additionally, the stabilities of the chemical species are investigated using density functional theory calculations. The ABHTMA is found to be the most stable molecule when trimethylamine is rich and borane and alane are close in their concentrations. The boran-trimethylamine is also found to be produced in alane-poor condition as a by-product.