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Fourier Transform Infrared Absorption Spectroscopy of Gas-Phase and Surface Reaction Products during Si Etching in Inductively Coupled Cl_2 Plasmas HIROKI MIYATA, HIROTAKA TSUDA, DAISUKE FUKUSHIMA, YOSHINORI TAKAO, KOJI ERIGUCHI, KOUICHI ONO, Kyoto University — A better understanding of plasma-surface interactions is indispensable during etching, including the behavior of reaction or etch products, because the products on surfaces and in the plasma are important in passivation layer formation through their redeposition on surfaces. In practice, the nanometer-scale control of plasma etching would still rely largely on such passivation layer formation as well as ion-enhanced etching on feature surfaces. This paper presents *in situ* Fourier transform infrared (FTIR) absorption spectroscopy of gas-phase and surface reaction products during inductively coupled plasma (ICP) etching of Si in Cl_2. The observation was made in the gas phase by transmission absorption spectroscopy (TAS), and also on the substrate surface by reflection absorption spectroscopy (RAS). The quantum chemical calculation was also made of the vibrational frequency of silicon chloride molecules. The deconvolution of the TAS spectrum revealed absorption features of Si_2Cl_6 and $SiCl_x$ (x=1-3) as well as $SiCl_4$, while that of the RAS spectrum revealed relatively increased absorption features of unsaturated silicon chlorides. A different behavior was also observed in bias power dependence between the TAS and RAS spectra.

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