REACTION OF SURFACES EXPOSED TO SOME HALOGEN CONTAINING PLASMAS

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ABSTRACT

Patterns in integrated circuit materials such as Si, SiO_2, Si_3N_4 and Al are routinely delineated by plasma etching. These processes are characterized by varying degrees of material specificity (selectivity), directional anisotropy and a large spectrum of rates. These factors are attributed to the chemistry of radical species and to plasma operating variables.

Several models for selective etching will be discussed: these include (1) intrinsic reactivity differences, (2) competitive film formation, and (3) selective recombinant adsorption. Recent investigations into undoped and doped silicon and SiO_2 etching by CF_4, C_2F_6, CF_3Cl, CF_3Br, Cl_2 and certain other halogen-containing plasmas are described and related to these models. The effect of oxygen and halogen additions is also discussed.

The intrinsic rates of some radical-substrate reactions have been measured in the absence of plasma by a discharge flow technique. The relative rates account for selectivity obtained during in situ plasma etching, but do not explain anisotropy.

Compounds: CF_4, C_2F_6, CF_3Cl, CF_3Br, Cl_2, F, Cl, Si, SiO_2.

Keywords: Plasma etching, surface reactions