Abstract Submitted
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Why does an SF_6 plasma etch silicon much faster than any other fluorine atom generating plasma?[1] VINCENT M DONNELLY, PRIYANKA ARORA, TAM NGUYEN, University of Houston — It has long been known that F atoms are the reactive species responsible for etching of silicon in all fluorine containing plasma. Despite this, SF_6 plasmas are widely found to etch silicon up to 100 times faster than the other fluorine-containing plasmas. We have found that this is due to the presence of adsorbed sulfur that catalyzes the fast reaction of F with Si. F atom reaction probabilities are ˜30-fold higher in SF_6 plasmas compared with values in NF_3 plasmas. Addition of only 10% SF_6 to an NF_3 plasma produced a much higher reaction probability (˜10-fold) than in a pure NF_3 plasma. By allowing sulfur in isopropyl alcohol to evaporate on masked Si samples, sulfur could be preferentially deposited in relatively high concentrations in selected regions. When this sample is placed side by side with one not exposed to sulfur, the sulfur-dosed sample etched several times faster at the center of each bead, while sulfur-free surfaces exhibited the expected slower rate. Discrepancies among previous published studies will be resolved. Mechanisms for the catalytic behavior, such as enhanced chemisorption of F and electronic effects caused by S mid-bandgap states in Si, will be discussed.

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