Low Temperature Plasma-Materials Interactions for Plasma Etching

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Plasma-based etching methods have been an essential part of the progress of nanomanufacturing required to build current semiconductor devices. Continuous advances in our ability to control plasma-based etching approaches to satisfy the requirements of advanced technology has been an important part of this development. In this presentation we will discuss several key examples of the recent evolution of challenges on plasma surface interaction control, along with possible approaches of meeting these.

One topic that has seen a great deal of recent development is atomic layer etching (ALE). In ALE one applies iteratively sequences of cycles consisting of reactant supply and surface reaction steps to establish self-limited material removal approaching one atomic layer. Since for ALE the reactant is injected only during the surface functionalization step, the surface changes continuously which has important implications for achieving materials etching selectivity. We will discuss several examples of how high materials etching selectivity in ALE may be achieved.

Another topic that has presented great challenges is plasma etching of high aspect ratio (HAR) features necessary for 3D fabrication. The general issue of how surface processes in HAR features may be controlled during the fabrication of such structures depends strongly on the nature of the materials through which etching takes place, and challenges our knowledge of atomistic processes in nanoscale features.