Plasma Assisted Atomic Layer Etching

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Atomic Layer Etching (ALE) is an etching technology which delivers atomic level fidelity for sub 10nm devices. It is characterized by temporal or spatial separation of self-limited steps. Typically, one of the steps is applied to modify the top layer or layers of the etching surface. The modified material is then removed in a second, so called removal step. Plasma can be used both in the modification or removal step.

This tutorial covers the elementary processes which take place in plasma assisted ALE such as adsorption, desorption and diffusion of reactive species as well as ion surface processes such as sputtering, implantation and scattering. Examples for how to combine these elementary processes into plasma assisted ALE processes will be provided. Modeling and experimental results will illustrate applications in semiconductor device manufacturing.

Benefits and limitation of plasma assisted ALE with respect to basic etching performance metrics such as uniformity, selectivity, profile control, aspect ratio dependent etching and process window will be discussed and contrasted to Thermal ALE, Radical Etching and Reactive Ion Etching.