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In situ optical diagnostics to understand plasma-surface interactions during atomic layer processing of Si-based dielectrics[1] SUMIT AGARWAL, Colorado School of Mines — The shrinking device dimensions in integrated circuits combined with the introduction of 3-D device architectures has created a need for novel atomic layer deposition (ALD) and atomic layer etching (ALE) processes for a variety of materials including Si-based dielectrics such as SiN_x and SiO_2. Development of new atomic layer processing techniques that can meet the demands for semiconductor manufacturing requires an atomistic level understanding of the surface reaction processes. In our lab, we utilize in situ optical diagnostic techniques including highly surface sensitive attenuated total reflection Fourier transform infrared spectroscopy and multi-wavelength ellipsometry to study the surface processes that occur during ALD and ALE. In this presentation, I will first discuss the low-temperature plasma-assisted ALD of SiN_x films where one of the key challenges has been to grow conformal films in high-aspect-ratio nanostructures such that the sidewall structure and composition is the same as the top surface. In the second part of the talk, I will discuss the atomistic-level details of an SiO_2 and SiN_x ALE process consisting of CF_x deposition from a C_4F_8/Ar plasma, and an Ar plasma activation step in which the CF_x film is activated and the underlying substrates are etched.

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