Plasma for Atomic Layer Processing: Anisotropy, Selectivity, Specificity and Sustainability

Jane P. Chang
Department of Chemical and Biomolecular Engineering, UCLA, Los Angeles, CA, USA

Abstract: This talk discusses four important aspects of plasma-surface interaction to support atomic layer processing of novel materials. This includes the effect of ions that control the etch anisotropy, the effect of surface chemistry that dictates reaction specificity and etch selectivity, and the broader impact of the plasma applications on chemical processing sustainability.

1. Introduction

This talk presents current advances in atomic scale processing of function accelerated nano-materials and the key challenges and opportunities in the future to enable novel integrated circuits for commercial and defense applications. Amongst all enablers, plasma processing science, due to its intrinsic nonequilibrium nature, is at the heart of many key technologies and provides breakthrough solutions in the information processing system hierarchy, translating physics to a physically functioning embodiment with enhanced device performance. To realize the full potential of novel materials, plasma surface science has become increasingly more important in material synthesis, material processing and device embodiment, all requiring atomic level control and precision.

2. Atomic Layer Etching and Key Examples

Atomic layer etching (ALE) enables precision in patterning for integrating novel material in nano-electronics, nano-photonics, spintronics, and sensors. To illustrate four most important aspects of plasma-surface interaction to support atomic layer processing of novel materials, this talk will discuss the effect of ions that control the etch anisotropy in patterning EUV absorbers, the specific and selective etching of SiGe alloy over Si, as well as the regeneration of catalysts for sustainable chemical processing.

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