Area Selective Plasma Enhanced Chemical Vapor Deposition of Silicon using a Fluorinated Precursor

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Area-selective deposition (ASD) is a process that controls where the deposition takes place through the underlying surface rather than through any masking step. This can be achieved by either Atomic Layer Deposition (ALD) or Chemical Vapor Deposition (CVD) techniques [1]. In previous work, we studied area selective plasma enhanced CVD (PECVD) using an $Ar/SiF_4/H_2$ plasma chemistry [2]. For specific plasma parameters, a microcrystalline silicon film is selectively grown on a SiO_xN_y area while the AlO_x adjacent area remains pristine (see figure 1). This effect was then attributed to the formation of Al-F bonds that blocks the deposition of silicon on top of the AlO_x area [3].
However, when the plasma conditions are changed or when those two materials are patterned using lithography, the selectivity is lost. Each case will be discussed and presented based on in-situ ellipsometry and X-ray photoelectron spectroscopy analyses.

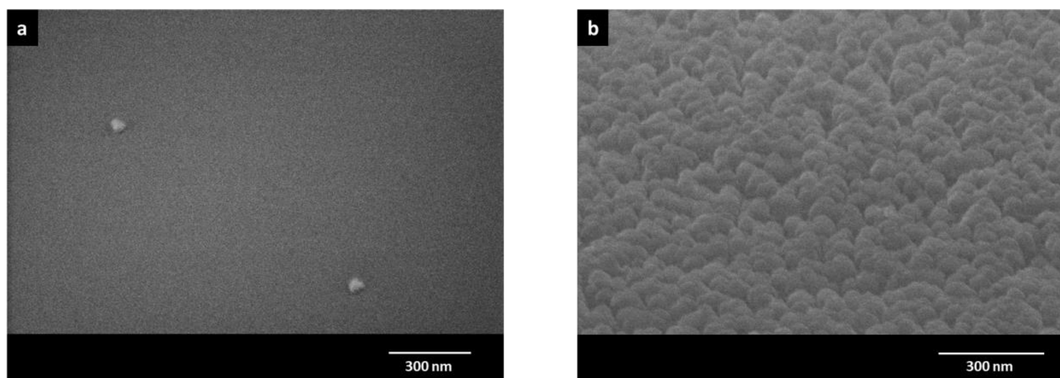

Figure 1 Top view Scanning Electron Microscopy (SEM) images of adjacent (a) AlO_x and (b) SiO_xN_y areas on the same substrate.

[1] G. N. Parsons and R. D. Clark, Chem. Mater. 32, 4920 (2020).
[2] G. Akiki, D. Suchet, D. Daineka, S. Filonovich, P. Bulkin, and E. V. Johnson, **Appl. Surf. Sci. 531, 147305** (2020).
[3] G. Akiki, M. Fregnaux, I. Florea, P. Bulkin D. Daineka, S. Filonovich, M. Bouttemy and E. V. Johnson, **J. Vac. Sci. Technol. A 39, 013201** (2021)