School of Nano Science

School of PHYSICS

IPM Condensed Matter & Statistical Physics Group

Weekly Seminar

Strategies for selective deposition of metal oxides materials on patterned substrates*

Invited speaker:

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Abstract:

As the sizes of microelectronic devices continue downward scaling, novel processing methods are needed to meet the increasingly difficult materials challenges associated with the new devices. To achieve complex planar geometries and 3-D structures with nanometer-scale feature sizes, selective deposition processes can help facilitate the fabrication process. Selective deposition approaches in device fabrication require a technique that can provide the deposition of different materials with a variety of thicknesses, while maintaining the selectivity up to high thickness limits. In this talk, I will present a novel area selective deposition approach using a combination of self-assembled monolayers (SAMs) and atomic layer deposition (ALD).

ALD is a good choice for selective deposition, because it is based on self-limiting reactions between gas phase precursors and specific functional groups at the growth surface. This chemical specificity provides a means to achieve selectivity in ALD on a spatially patterned substrate. Selectivity is obtained by passivation of the surface using SAMs in the regions where deposition is not desired.

Our results show that regeneration of the SAMs protecting layer between ALD cycles is effective in improving the properties of the blocking layer. This strategy provides the ability to carry out selective deposition for film thicknesses greater than 100nm. We also show that by combining selective deposition and etching of materials, process time can be significantly decreased and selectivity limits for deposition of different high-κ dielectric materials can be improved up to more than 10 times. This opens up possibilities for new applications in next-generation electronic devices.

* This work has done as part of her PhD thesis at Stanford University.

Wednesday, 2 Esfand 1396 (Feb. 21, 2018), 14:00-15:00

Seminar Room (classroom A), Farmanieh Building, IPM