**AVS 2021** TF2+2D+AP+SS: ALD and CVD: Surface Reactions, Mechanisms, and Kinetics

## Insight into Film Growth Mechanisms in Polyurea Molecular Layer Deposition Using New and Combined Precursors

## 100 <sub>80</sub> (b) (a) Growth Rate (ng/(cm<sup>2\*</sup>cycle)) (c) 40°C 30 Mass Uptake (ng/cm<sup>2</sup>) 000 0001 0001 0001 60 Steady PDIC/ED Mass Uptake (ng/cm<sup>2</sup>) PDIC PDIC/ED 40 PDIC/FD 10 20 0 30 Evacuation 30 HDIC/ED HDIC/ED Initial I. Dose 20 20 ED HDIC Purge 10 HDIC/ED 300 400 Time (s) 0 200 500 1x10<sup>4</sup> Time (s) 100 600 700 ٥ 2x10<sup>4</sup> 3x10<sup>4</sup> 30 20 Cycle

## **Rachel Nye, Siyao Wang, Gregory Parsons**

**Figure 1:** QCM data of polyurea deposited from PDIC/ED (red) and HDIC/ED (blue) at 40 °C. (a), (b) mass uptake versus time, and (c) mass growth rate versus cycle. A higher growth rate is demonstrated for the more rigid PDIC/ED film. Additionally, a decreasing growth rate is observed for initial HDIC/ED growth on a metal oxide  $(Al_2O_3)$  substrate compared to deposition on the bulk polymer.



**Figure 2:** (a) Schematic of polymer growth on various substrates. Flexible HDIC/ED (aliphatic) has a decreasing growth rate on SiO<sub>2</sub>. During subsequent PDIC/ED (aromatic) deposition on the aliphatic surface, the growth rate increases corresponding to increasing active sites. (b) Expected and (c) actual growth rates (in situ ellipsometry) for each polymer deposited on various substrates (SiO<sub>2</sub>, aromatic polymer, or aliphatic polymer).