Docket #: S20-277

Advanced precursor for selective atomic layer deposition of Al2O3

Selective atomic layer deposition (ALD) is a critical component of advanced manufacturing and offers an alternative to lithographic procedures. Traditional precursors such as $AlCl_3$ or $AlCl_2$ CH_3 are used for Al_2O_3, but these precursors show poor are selectivity with increased deposition cycles. These smaller precursors more easily penetrate the self-assembled monolayers (SAMs) used to pattern the silicon surface, and bind to the surface creating nucleation sites for growth during subsequent cycles. Purging the chamber can prevent this problem, but adds time and cost to the manufacturing process. Here Stanford researchers utilized a new ALD precursor, $Al(CH_3)_3$ which shows >98% selectivity over 75 cycles. This bulkier precursor has reduced reactivity and is unable to penetrate the SAMs, leading to increased selectivity. Overall, $Al(CH_3)_3$ is an improved precursor for selective ALD and offers a template for design other precursors used in selective ALD.

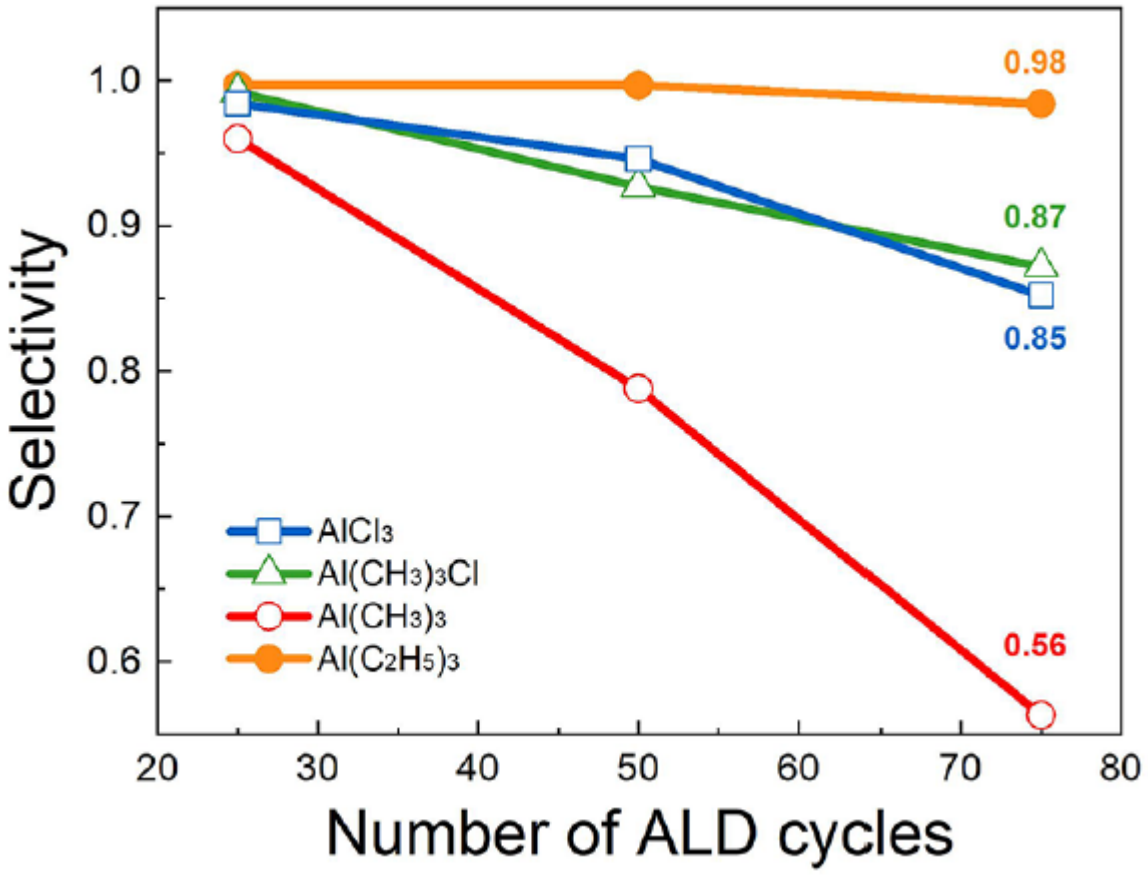

Photo description: Selectivity of ALD precursors as a function of cycles. Photo credit: Oh et al. Chemistry of Materials (2021).

Stage of Research

- Prototype

Applications

- Selective ALD of Al_2O_3
- Fully self-aligned via (FSAV) fabrication using topography

Advantages

- >98% selectivity up to 75 cycles (equivalent to 6 nm thickness)
- Low surface roughness and precise thickness control
- High uniformity

Publications

- Oh et al. Chemistry of Materials (2021) Role of Precursor Choice on Area-Selective Atomic Layer Deposition

Patents

- Published Application: 20220136106

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