(Supplemental)

Molecular Atomic Layer Deposition of Inorganic-Organic Hybrid Dry Resist for EUV Application

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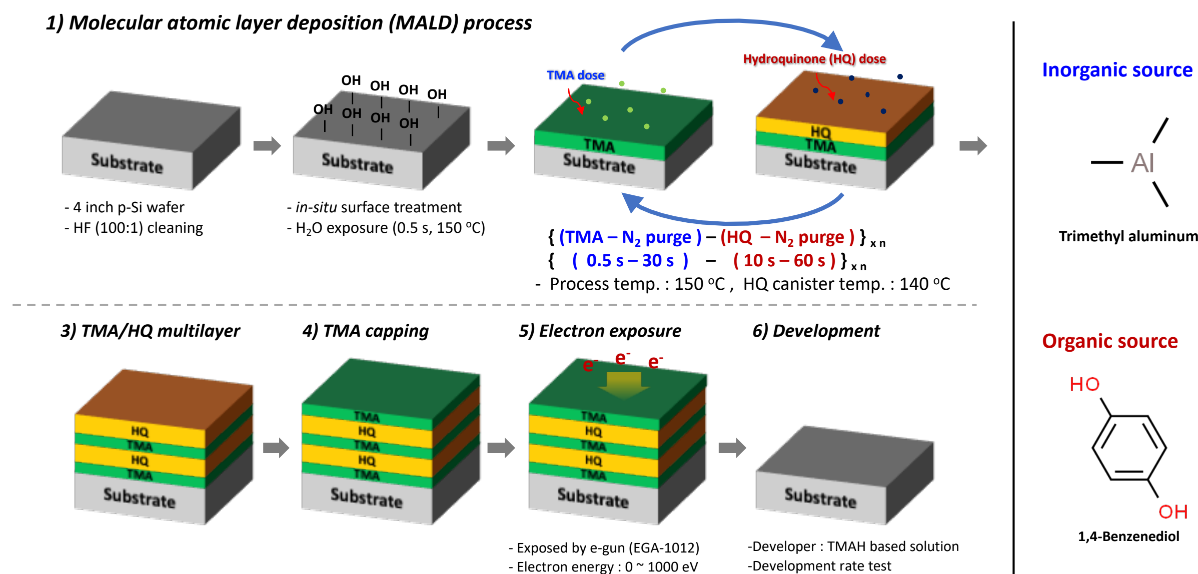

Figure 1. Schematic representation of the process flow. Trimethylaluminum (TMA) and hydroquinone (HQ) were used as the inorganic and organic sources, respectively. HQ was evaporated at a temperature between 140–160 °C. Figure 1 displays the flow of deposition and electron exposure processes. A complete single TMA/HQ cycle consisted of 0.5 s TMA pulse, 30 s N_2 purging, 10 s HQ pulse, and 60 s N_2 purging. At the end of MALD, TMA pulse was introduced to form a capping layer. After the deposition, the electron exposure and developing process can be performed.

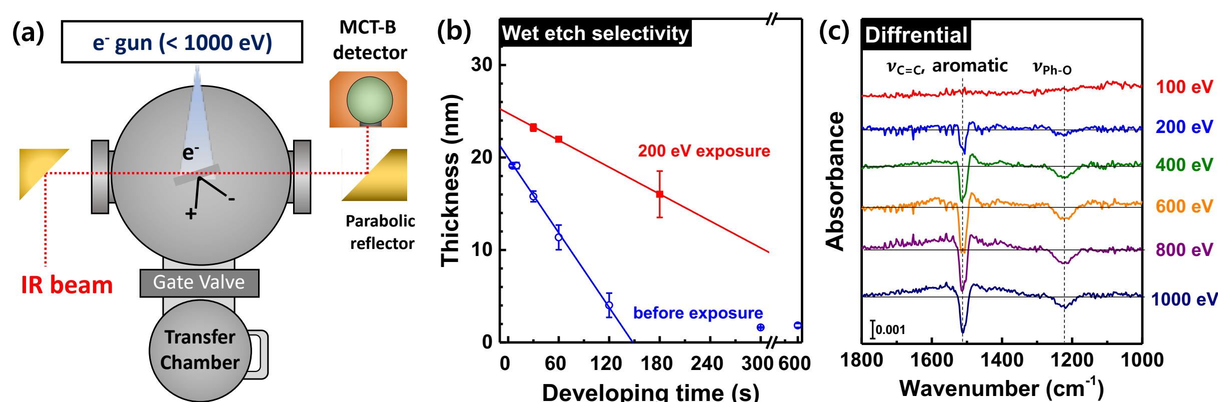

Figure 2. (a) Schematic of home-built *in-situ* FTIR system with electron flood gu, (b) wet development result of as-deposited (blue) and after electron exposure at 200 eV (red) wint TMAH-based developer, and (c) differential spectra of TMA/HQ hybrid materials with subsequent electron exposures. The TMA/HQ hybrids with electron exposure above 200 eV exhibited the enhanced wet etch resistance using 0.1% AZ 300 MIF developer, suggesting that the TMA/HQ hybrids show negative-tone resists feature. In *in-situ* FTIR analysis with subsequent electron exposures, aromatic ring (C=C) and Ph–O bond peaks in HQ molecules decreased in intensity.