

Area Selective Deposition for ZnO Hard Mask by 2D-like Carbon fabricated by Molecular Layer Deposition

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Area selective deposition (ASD) is a promising technique as a bottom-up process for creating improved overlay or self-alignment, attaining errorless alignment, increasing yield, and reducing cost of manufacturing. The selectively grown metal or metal oxide can be employed as a robust hard mask. For bottom-up process, area selective atomic layer deposition has been researched vigorously using surface chemistry. In this research, a strategy for ASD using molecular layer deposition (MLD) is introduced, which is useful for conformal deposition of organic layer that delays film growth.

An indicon layer, which has alkoxide structure, was fabricated by MLD process using INCA-1 (bis(trimethylsilyl)-amidodiethylindium) and HQ (hydroquinone), and was thermally annealed. The atomic structures of as-dep and annealed indicon films were analyzed by XPS and Raman spectra. The indium was almost completely removed with annealing process, and carbon structure was transformed to graphitic carbon above 450 °C annealing temperature. The thermally annealed indicon was used as an inhibitor, which can delay 60 cycles of ZnO (equivalent to a thickness of about 11nm). In addition, to prove chemical mechanism of precursor adsorption on graphitic carbon, density functional theory calculations were utilized. Finally, ALD ZnO was selectively deposited on Al₂O₃/SiO₂ line pattern for interconnecting SiO₂ line pattern by transferring hard mask using RIE.

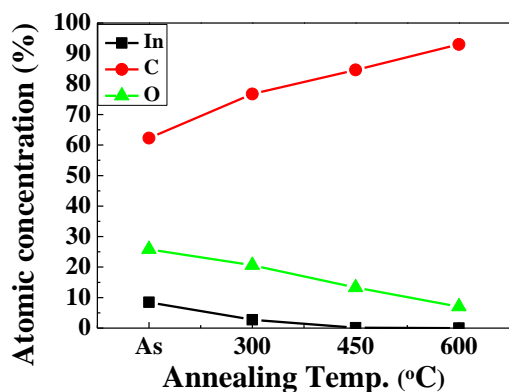


Figure 1. Atomic concentration of as-deposited and post-annealed indicon

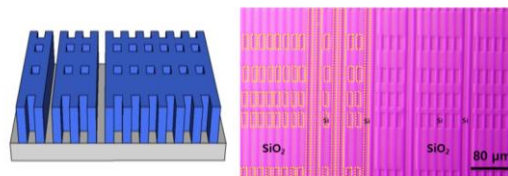


Figure 2. Interconnected SiO₂ pattern by selective deposited ZnO hard mask