Elevating Atomic Layer Deposition to the Angstrom Era

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The successful continuation of Moore's Law in the coming decade hinges on adopting various paradigm shifts in device fabrication [1]. Major examples include a strong focus on 3D scaling for transistor and memory architectures instead of horizontal shrinking, employing more selective and self-aligned processing steps for feature alignment implementing bottom-up approaches rather than solely relying on top-down methods, and the crucial integration of new materials and materials systems, even abandoning the long-held dominance of silicon as channel material.

Scaling in device fabrication has therefore rapidly progressed beyond almost exclusive reliance on lithography, witnessing a growing dominance of atomic-scale processing by deposition and etch technologies. In particular, the utilization of atomic layer deposition (ALD) has become crucial in cutting-edge device fabrication and will undoubtedly play a pivotal role in facilitating the aforementioned paradigm shifts when entering the Angstrom era.

This presentation will highlight several ongoing advances in the field of ALD [2]: how the 3D potential is amplified through conformal nanolayers and seamless gap-filling; how selective deposition is empowered through area-selective and topological-selective approaches, and how novel materials are pioneered through engineering their composition and phase and establishing new processes for 2D materials.

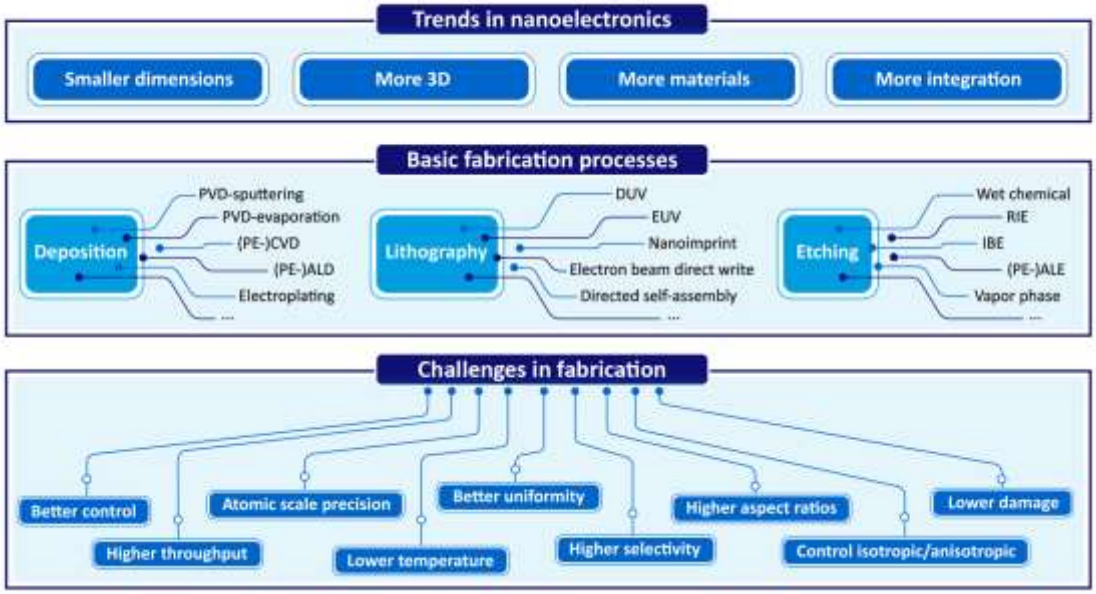

Fig. 1. Trends and challenges in the fabrication of nanoelectronics. These will intensify when transiting to the Angstrom era in the coming decade, with atomic scale processing methods for deposition and etching playing a central role.

References

1. K. Arts, H.C.M. Knoops, W.M.M. Kessels, A.J.M. Mackus, S. Hamaguchi, K. Karahashi, and T. Ito, *Plasma Sources Sci. Technol.* 31, 103002 (2022).
2. See blogs and databases on www.AtomicLimits.com