

Atomic Craft of Materials by Atomic Layer Deposition : Neuromorphic and Powder technology

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It has been proven that atomic layer deposition (ALD) can provide highly uniform film growth on the wide area of substrate, conformal growth on the nanostructures with complicate shape, and controllability of thickness and composition; Atomic craft of materials enabled by ALD has indeed attracted a lot of attention from many industrial and research fields in the electronics and energy, etc.

Herein, 8-year of efforts at Seoultech for atomic craft of materials for electronics and energy applications will be introduced, putting special emphasis on ALD-enabled functionalization of materials. 1) Energy-efficient memristor crossbar arrays are demonstrated for image recognition tasks that are potentially adopted for IoT sensors for neuromorphic computing. The adoption of the selector-free memristor device with a self-rectifying function enabled by ALD could allow for simple stacking of metal-dielectric-metal layer, thus significantly simplifying the fabrication process while achieving low-current operation ($< 10 \mu\text{A}$ in micro-device). 2) ALD could also been used for functionalizing the surface of powder materials for efficient energy conversion. SnO_2 coating on carbon nanofiber as electrode materials of fuel cell and ZnO coating on thermoelectric materials have been studied for surface and interface engineering by ALD.