Self-Assembled Al Nanopipes and Al-Al2O3-Pt Nanocoaxes via ALD

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We have developed a self-assembly process to grow aluminum nanopipes using ALD. HRTEM and EDS show the nanopipes to be composed of polycrystalline FCC Al, with crystallite size ~10 nm. SEM investigation reveals that the nanopipe inner diameters range from 100 to 500 nm, with ~20 nm wall thickness and up to 200 μm length. We have further used these nanopipes as the cores of nanocoaxes by coating them with Al2O3 and Pt, both via ALD. This appears to be the first observation of Al nanopipe/nanotube growth. Both the pipe and coax nanostructures have potential utility in optical waveguiding,¹² high efficiency photovoltaics,³ and biochemical sensing,⁴ among other possibilities.


Left: Dark-field optical micrograph of 50 μm-long Al nanopipe (with ~10 μm-long 2nd section) formed via self-assembly ALD.
Right: Nanoscale coaxial cable (nanocoax) formed entirely by ALD, with inner conductor by self-assembled Al nanopipe, dielectric annulus by conventional ALD Al2O3 and outer conductor by Pt ALD.

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