

Fabrication of sub-15nm nanostructures via metal lift-off or silicon etching

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The fabrication of nanoscale structures with small feature sizes is important for many facets of nanotechnology from nanoelectronics and nanophotonics, to self-assembled nanostructures and bio-nano devices. We report progress on the development of processes to fabricate sub-15 nm feature sizes, with an emphasis on successful pattern transfer via metal lift-off or etching. Three commonly used resists are investigated using 30keV electron beam lithography systems^{1,2}: a standard positive resist for lift-off, PMMA³; a positive resist for etching, ZEP520⁴; and a high resolution negative e-beam resist, NEB-22⁵.

We investigate different exposure and development parameters, such as temperature controlled development and ultrasonically-assisted development and lift-off, to achieve feature sizes in the sub-15nm range. For PMMA, metal lines and dots below 10 nm have been achieved in single layer structures via metal lift-off. We also look at layering features, such as metal gates, on top of each other for more complex device structures. All details of the process flow, including laboratory conditions and process flow time-scales, will be presented.

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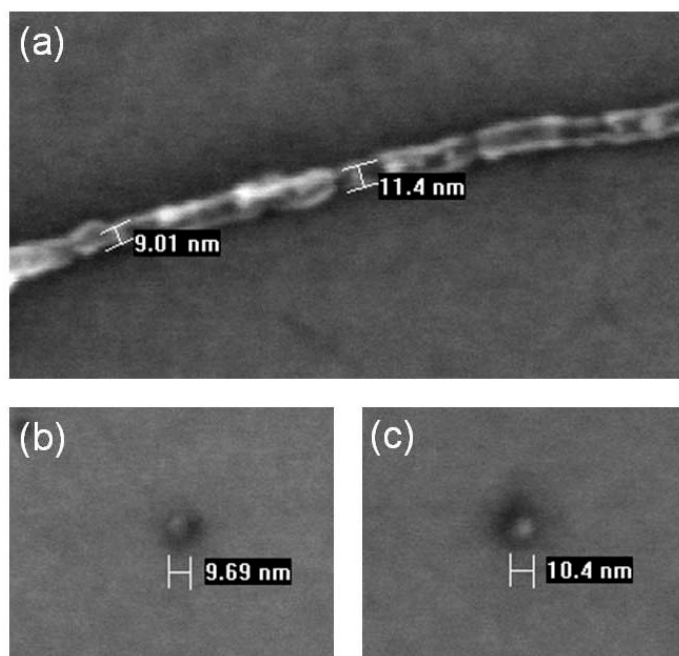


Figure 1: (a) TiAu gate with linewidth ~ 10 nm via lift-off. (b) and (c) TiAu nanoparticles with diameter ~ 10 nm via lift-off.