Sub-10 nm Device Fabrication in a Transmission Electron Microscope

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Abstract. We show that a high-resolution transmission electron microscope can be used to fabricate metal nanostructures and devices on insulating membranes by nanosculpting metal films. Fabricated devices include nanogaps, nanodiscs, nanorings, nanochannels, and nanowires with tailored curvatures and multi-terminal nanogap devices with nanoislands or nanoholes between the terminals. The high resolution, geometrical flexibility, and yield make this fabrication method attractive for many applications including nanoelectronics and nanofluidics.

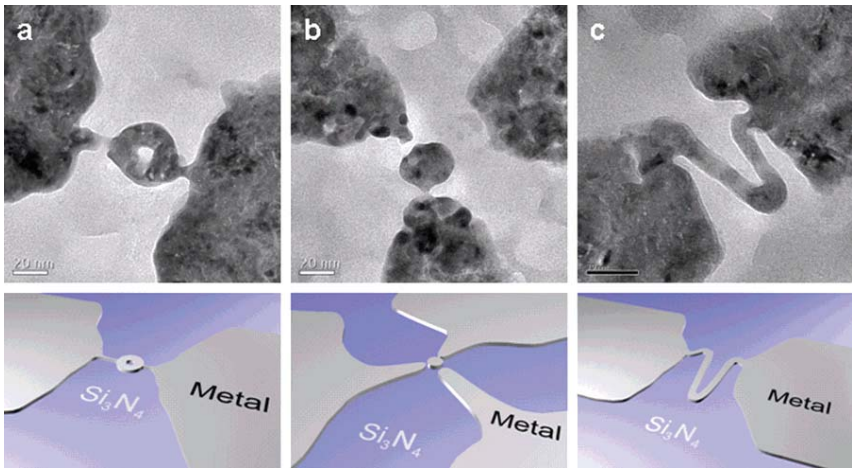

FIGURE 1. TExample structures to demonstrate the flexibility of TEBAL. Each of the three structures shown in the TEM images is accompanied by a schematic (below) showing the fabrication by TEBAL. (a) Nanoring with outer radius of 18.5 nm and inner radius of 3 nm (scale 20 nm). (b) Three-terminal electronic device: source and drain leads are coupled to a 13 nm radius metallic island and a gate electrode 23 nm away from the island (scale 20 nm). The rate-limiting tunneling barrier (upper junction) is a 2.7 nm gap. (c) Serpentine wire with 6 nm width (scale 20 nm). All lengths were measured with Gatan's Digital Micrograph image analysis software.

REFERENCES

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