Parallel Fabrication of down to 3nm Gaps in Metallic Nano-Antennas

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Nano-antennas have drawn many attentions in recent years. To fabricate nano-antennas with small gaps (~10nm) is critical for achieving high field enhancement factors. Consistent fabrication of these nano-gaps allows the studies to be done in a systematic and reliable manner. In this letter, we introduce a novel approach for the preparation of large quantities of well controlled miniature gaps in metallic nano-antennas. It combines e-beam lithography, reactive ion etching, and ion beam milling techniques. With this method, arrays of nano-antennas with less than 5nm wide gaps that have well defined shape and local geometry can routinely be fabricated. We will show that with fine-tuned processing conditions, very small gaps of between ~3 nm wide can be made in Au and Pt nano-antennas. Potentially, novel structured plasmonic devices such as closely coupled arrays of metal nano-features with ~5nm slits can also be fabricated with minor modification of this method. In addition, the same process can be employed to fabricate small gaps in nano-electrodes for molecular electronics research.

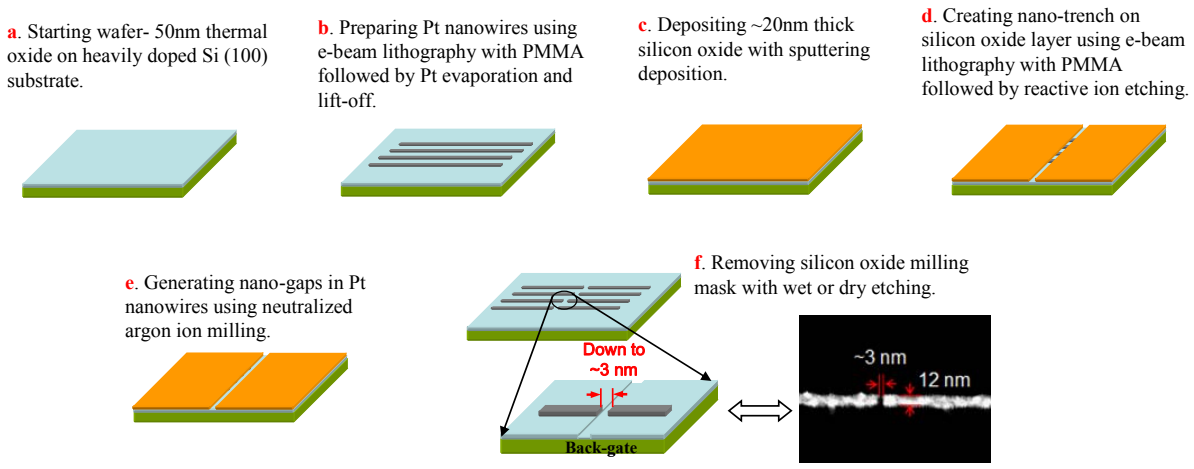

Fig 1: Fabrication process flow for down to 3nm gaps in nano-antennas.