

# Growth of Nanocrystalline Germanium on Plasmonic Nanoantennas

R. O'Meara, R.G. Hobbs

*Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN) and the SFI Advanced Materials and Bio-Engineering Research Centre (AMBER), Dublin 2, Ireland;  
School of Chemistry, Trinity College Dublin, The University of Dublin, Dublin 2, Ireland*

Controlled growth of semiconductor materials at precise nanoscale locations is an important step in the production of nanoelectronic devices. Fabrication of semiconductor nanostructures directly on nanophotonic devices will support the development of novel nanoscale light sources and photodetectors. Nanocrystalline germanium has recently attracted much attention for its uses in communications devices such as photodetectors and emitters<sup>1</sup>. Here, we design and fabricate plasmonic gold nanoantennas resonant at 785 nm using electron-beam lithography (EBL). The nanoantennas are immersed in a germanium precursor solution and illuminated with a 785 nm laser as shown in Figure 1<sup>2</sup>. The surface plasmon resonance of the nanoantennas subsequently induces the growth of nanocrystalline germanium directly on the surface of the antennas. Plasmon-assisted growth of germanium nanostructures has been demonstrated previously using vapour-phase precursors and chemically synthesised gold nanoparticles<sup>3</sup>. Here, we employ a simpler solution-phase approach with lithographically-defined plasmonic nanoantennas to achieve germanium nanostructure growth at controlled locations<sup>3</sup>.

Germanium growth is confirmed by analysis with both surface-enhanced Raman spectroscopy (SERS) and energy dispersive x-ray spectroscopy (EDX). We expect that the growth of nanocrystalline germanium directly on nanophotonic structures will enable the development of nanoscale emitter and detector devices for integration in future optoelectronic devices.

## References

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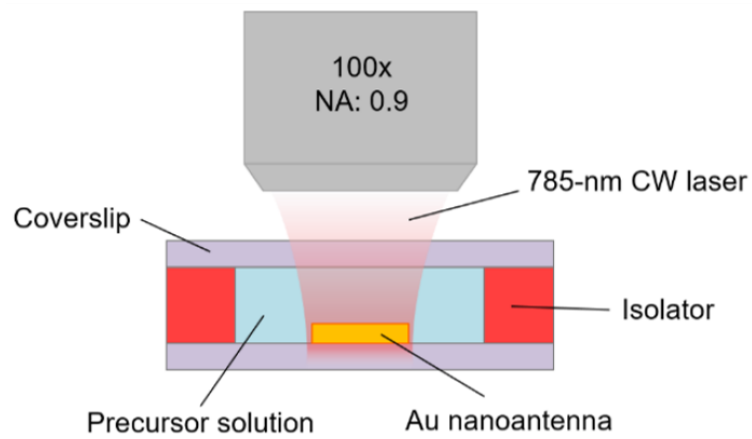


Figure 1: Schematic of experimental setup for growth of nanocrystalline germanium<sup>2</sup>.

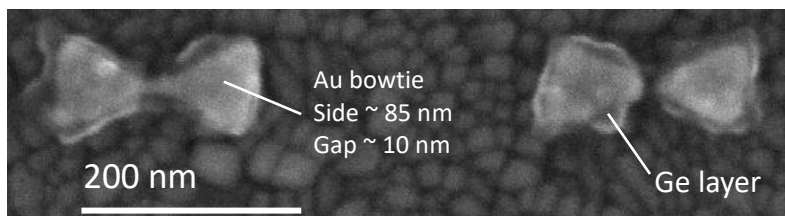


Figure 2: SEM image of a pair of gold bowties coated in germanium that has been grown on the surface.