Tunable Si-NP Light Emission via SF_6 In-Flight Etching

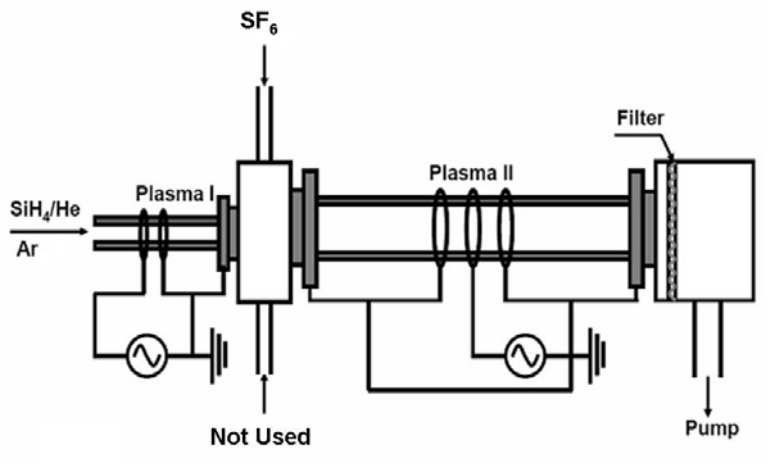
Uwe Kortshagen (PI), Steve Campbell(PI), Rick Liptak

Mechanical Engineering, Electrical & Computer Engineering, University of Minnesota

NNIN Facilities utilized: Characterization Facility & Nanofabrication Center

DESCRIPTION OF WORK

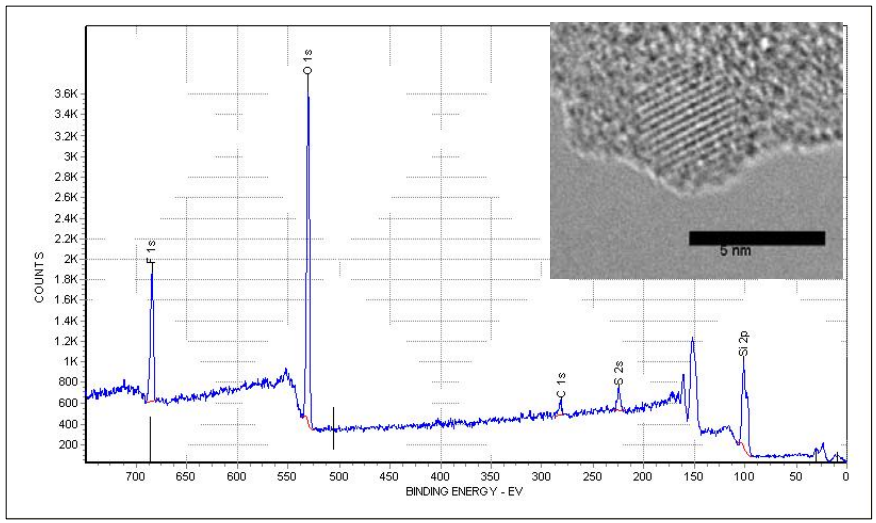
- An in-flight SF_6 plasma was used to control the size and PL of Si-NPs.
- Earlier work has shown[1-2] that CF_4 etching of Si-NPs allows for tunable light emission, but leaves a CF_x layer on the surface of the NPs. This layer effectively passivates the surface states, but prevents further processing. SF_6 based plasmas do not suffer from this problem.



System Schematic

MAJOR OBSERVATIONS

- Full Spectrum Emission from Si-NPs.
- PL Quantum Yields as high as 36% have been achieved with SF_6 etched Si-NPs.



XPS Survey of the SF_6 etched Si-NPs. Inset: HRTEM of SF_6 etched Si-NPs

Publications

- [1]"Atmospheric Full Visible Spectrum Emission from Silicon Nanocrystal Ensembles Synthesized by an all Gas Phase Approach", Submitted to Nature Nanotechnology (2007).
- [2]Appl. Phys. Lett. **91,** 083112-1 (2007).
- "In-Flight Etching of Si-NPs with SF_6", In Preparation (2008).