

Nanostructured Titania

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Major: Biopsychology

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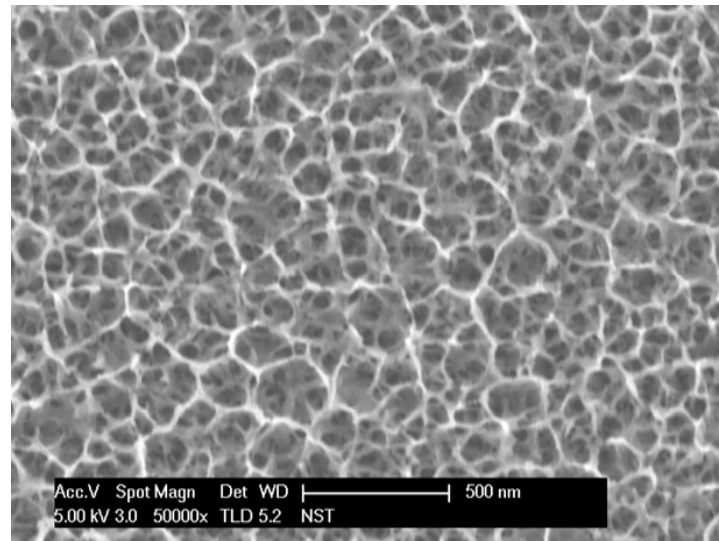
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Chemistry Department



What is Nanostructured Titania?

- Anatase TiO_2
- Metal Oxide with a diverse structure containing high surface area
- Modified with silane and nanoparticles for variety of applications



Applications



- Low Pressure Gas Sensing
- Biomolecular detection
- Vapor detection using Surface Enhanced Raman Spectroscopy (SERS)
- Mass spectrometry

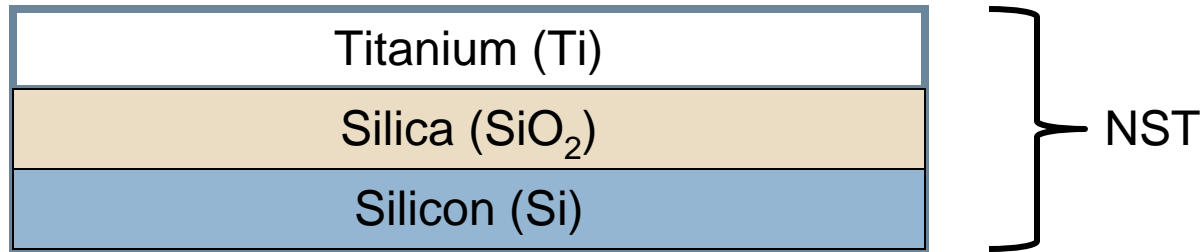
Goals of the Summer



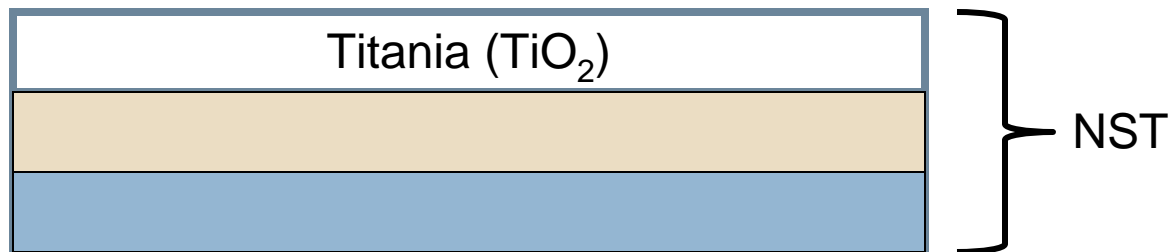
- Synthesize Nanostructured Titania (NST) substrate
- Functionalize substrate with various organo silane molecules and colloidal nanoparticles
- Characterize modified substrate via Scanning Electron Microscopy (SEM), Raman Spectroscopy, and Electrical Measurements

Synthesizing NST substrate

- NST substrate consist of:

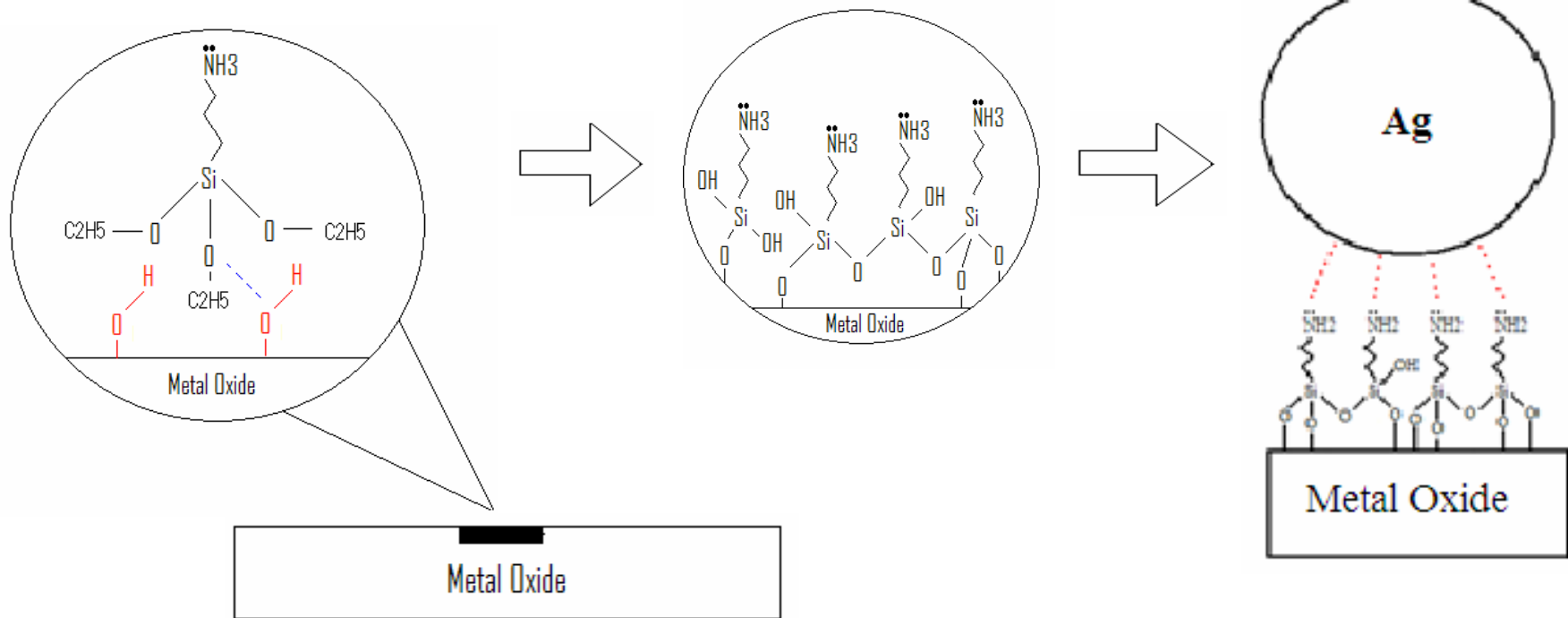


- Oxidized in 10% Hydrogen Peroxide at 80°C



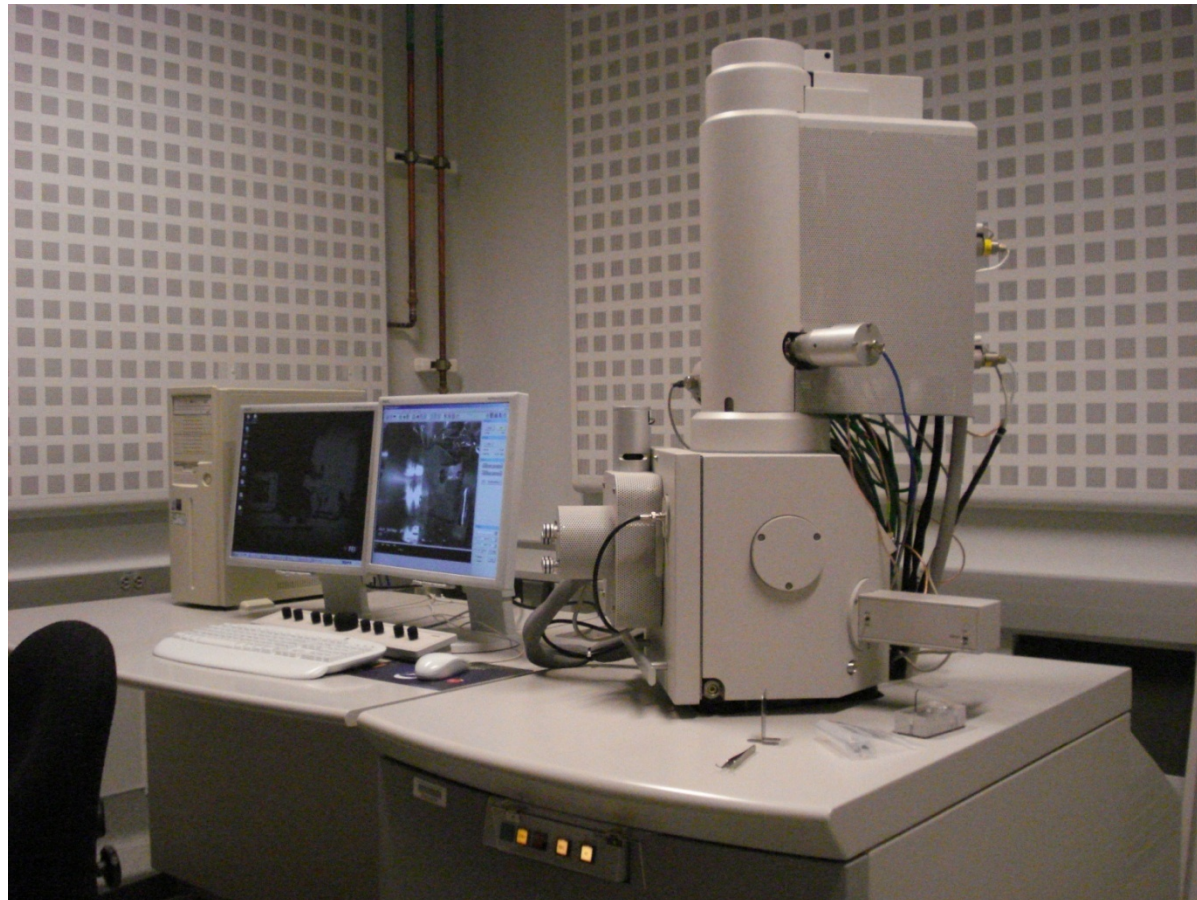
Functionalize with Organo Silane and Colloidal Nanoparticles

3-Aminopropyl triethoxy

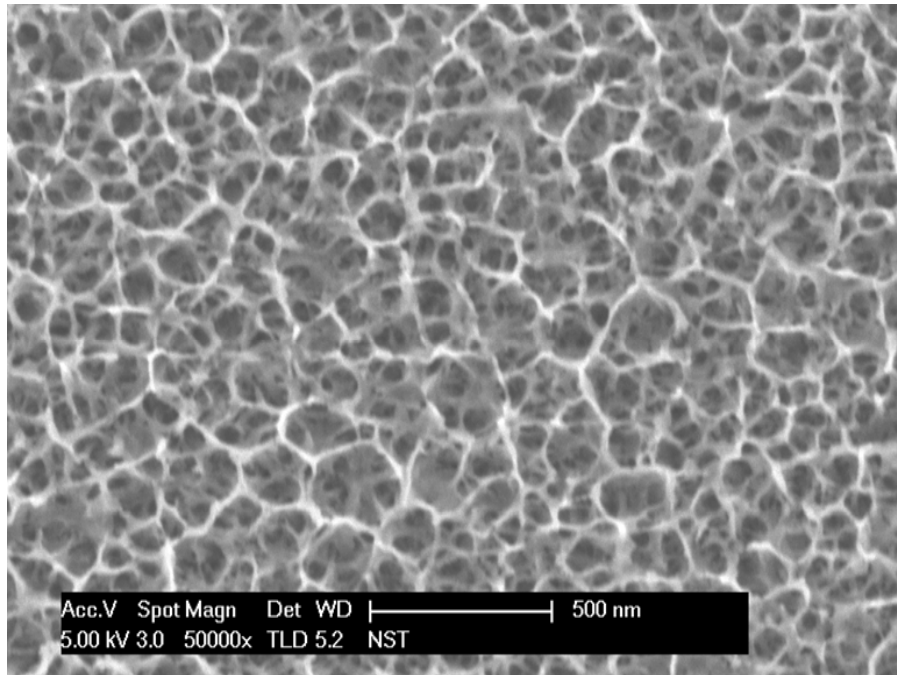


Characterize modified NST substrate

- Scanning Electron Microscopy (SEM)

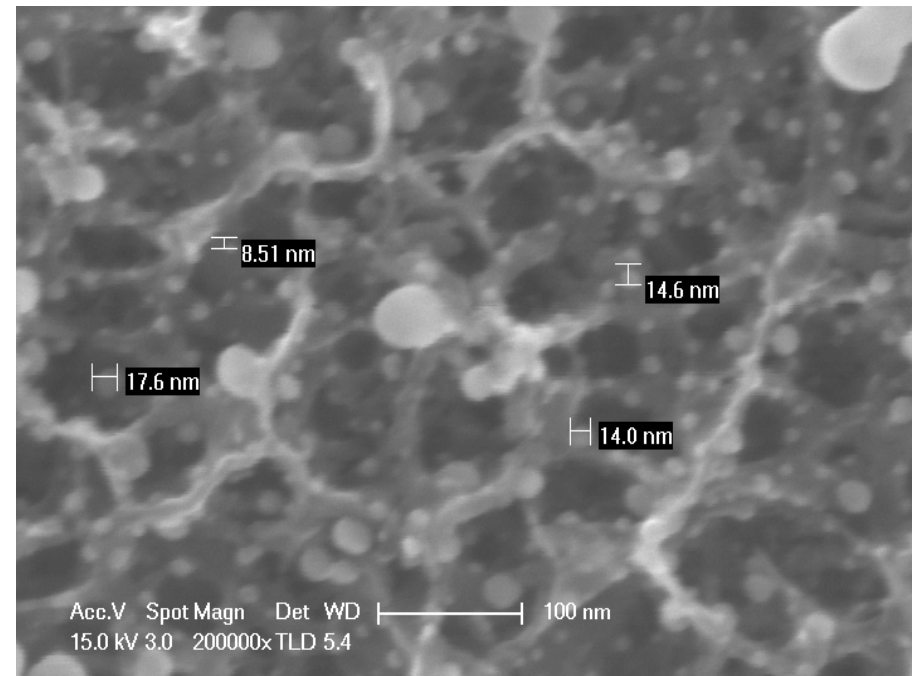


Control Experiment

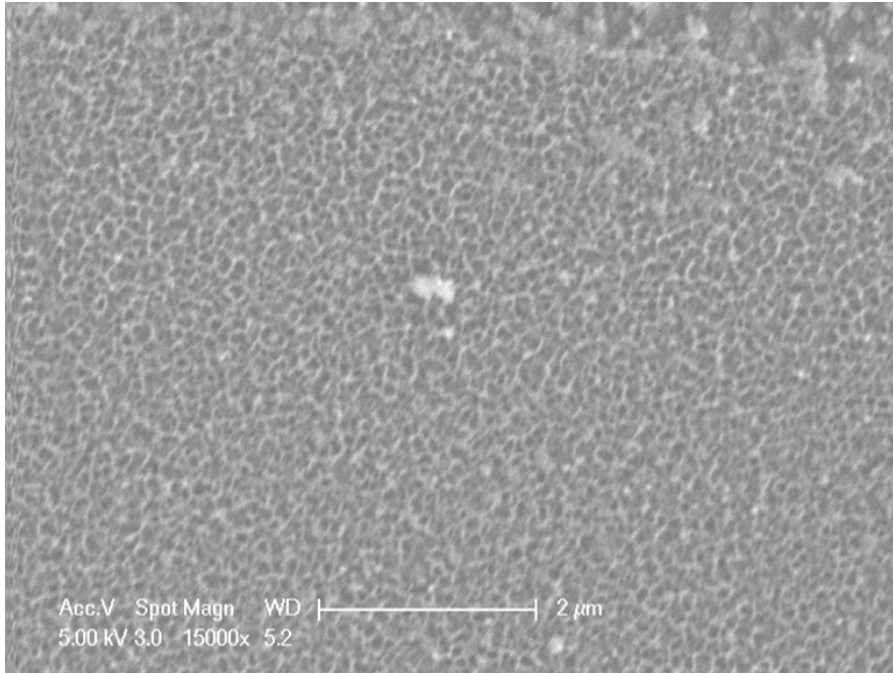


NST not treated with silane,
but treated with Silver (Ag)
nanoparticles

NST treated with silane and
Silver (Ag) nanoparticles

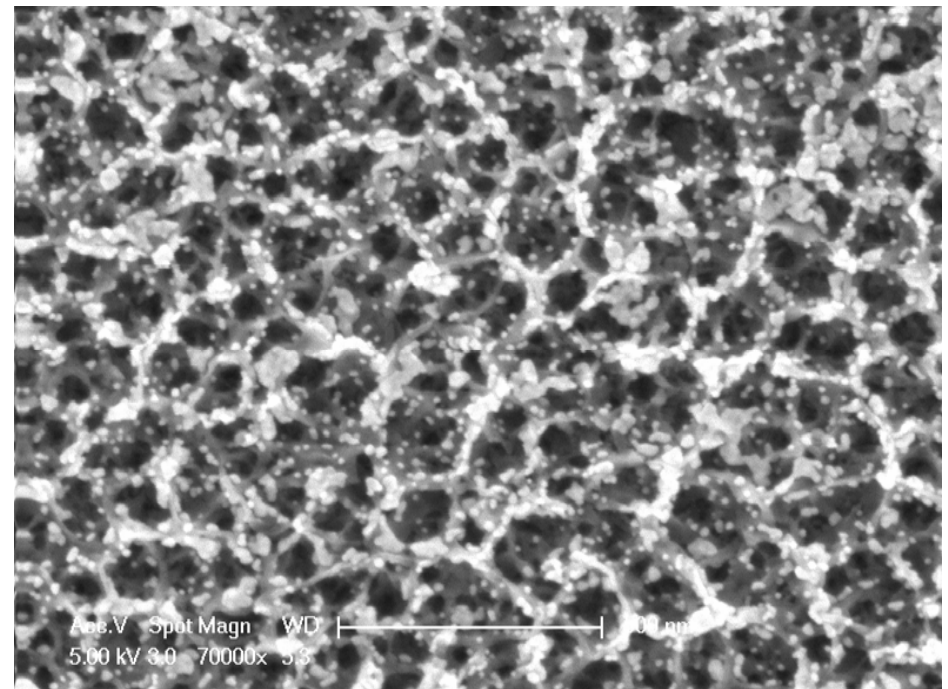


SEM Images of NST with AuNP



↑
NST not treated with silane,
but treated with Gold (Au)
nanoparticles

NST treated with silane and Gold
(Au) nanoparticles



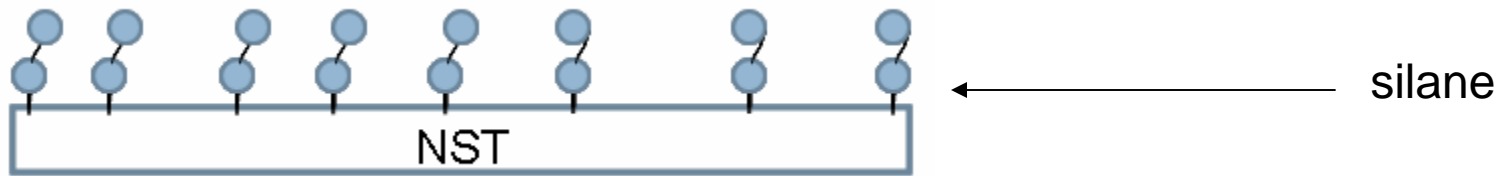
Applications for modified NST substrate

- Surface-Enhanced Raman Spectroscopy



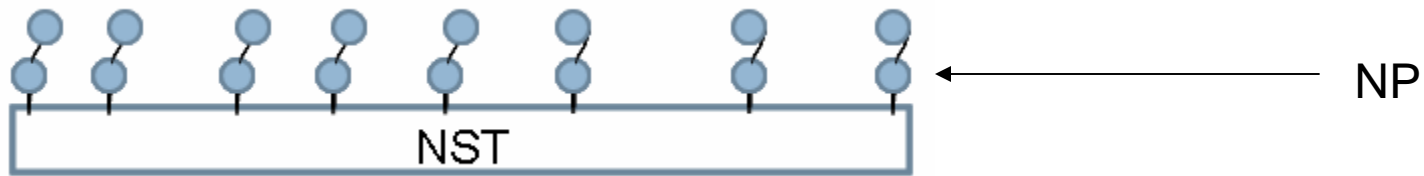
Applications for modified NST substrate

- Raman effect



Applications for modified NST substrate

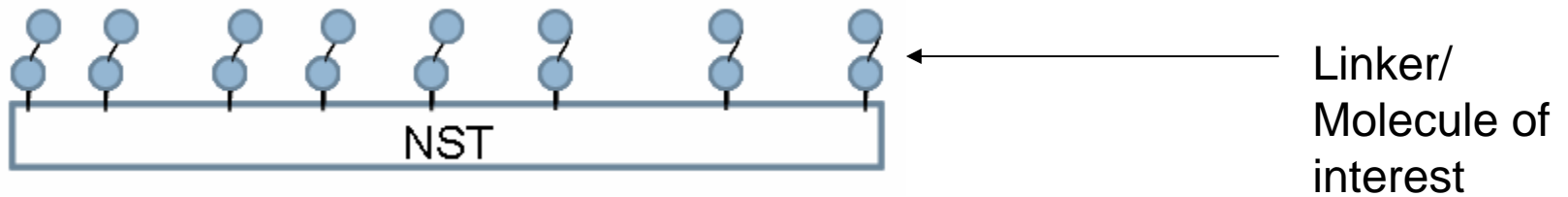
- Raman effect



NP = nanoparticle

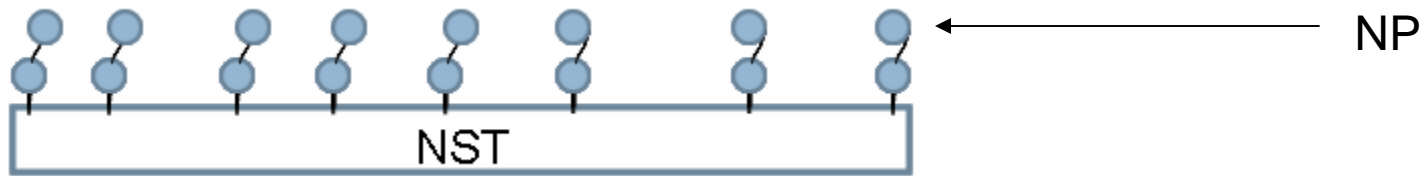
Applications for modified NST substrate

- Raman effect



Applications for modified NST substrate

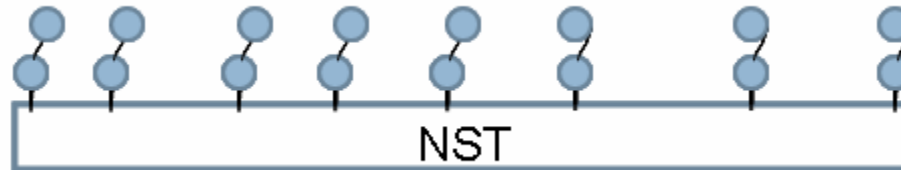
- Raman effect



NP = nanoparticle

Applications for modified NST substrate

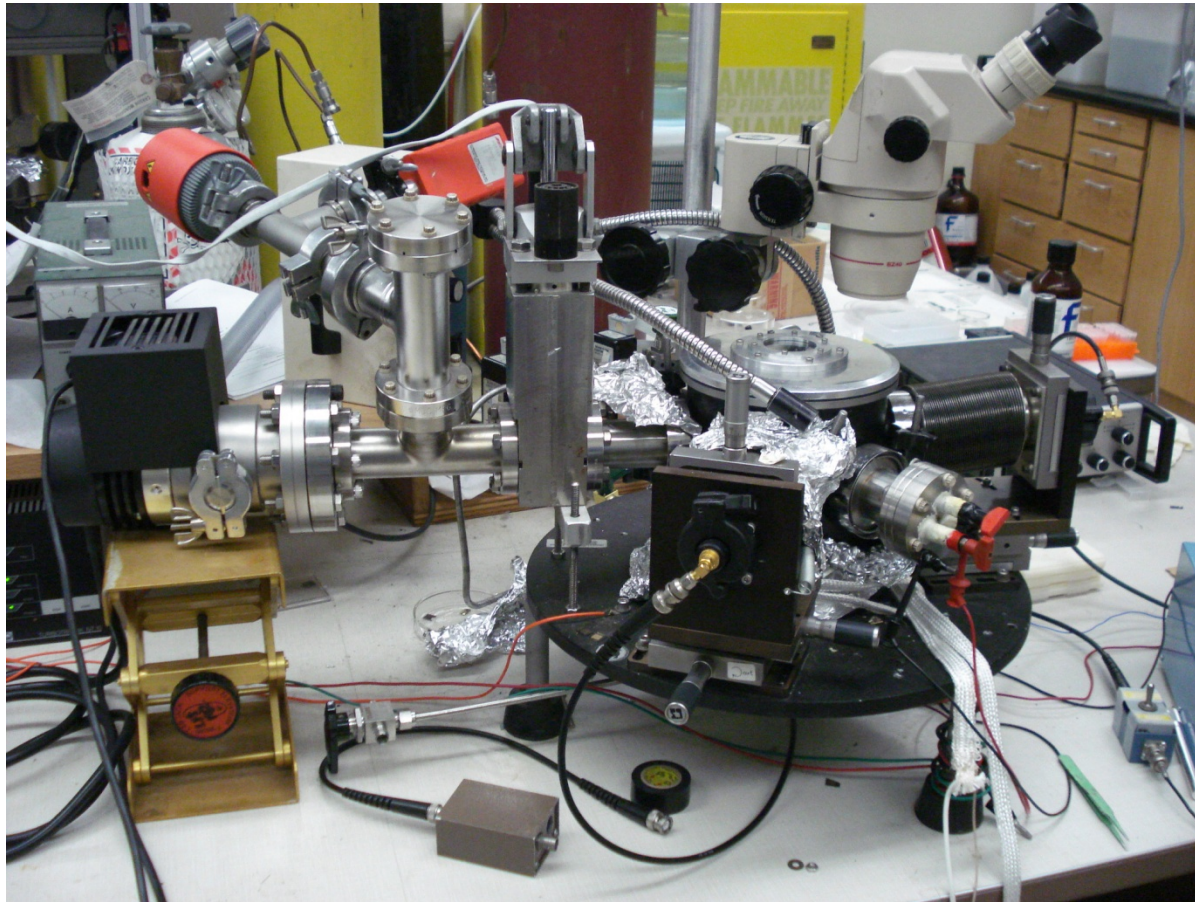
- Raman effect



- Formation of Raman active substrate
- Applications in solution and airborne analyte detection

Applications for modified NST substrate

- Electrical Measurements



Conclusion



- Successfully synthesized NST substrate
- Deposited silane and nanoparticles onto the NST substrate
- Characterized samples using SEM

Future work



- Obtain Raman spectrum for various linkers and metal nanoparticles
- Fabricate contact pads for NST substrates
- Perform electrical measurements



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