

# Materials and Surface Characterization Facilities at UAHuntsville

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Chemistry / Chemical & Materials Engineering

# Materials Outline

## My Interests

## Characterization

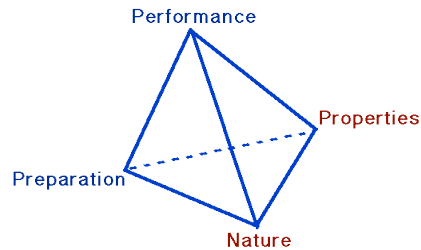
Techniques  
Microscopies

## Examples

## Conclusions

## ▼ Materials Science & Technology

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Nature

Chemistry  
Structure  
Phases

Properties

Response to an  
External Stimulus

Performance

Success / Failure

Preparation

Synthesis  
Processing

## ▼ Surface Science & Technology

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What is a surface?



Wolfgang Pauli

“God created the volume, but the surface was invented by the devil”



A thin region between two phases.

1 – 100 layers of atoms or molecules

## ▼ Surface Science & Technology

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What are my interests?

### Nature

Chemistry  
Structure  
Phases

### Characterization

What is in it?  
How much is in it?  
How are they bonded?  
What is their arrangement?

### Properties

Response to an  
External Stimulus

### Collaboration

### Performance

Success / Failure

### Preparation

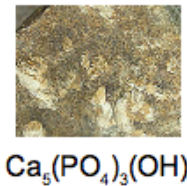
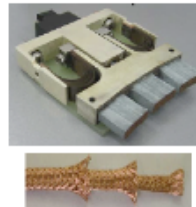
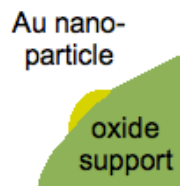
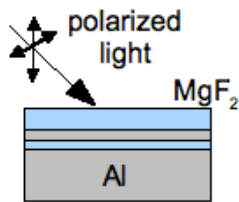
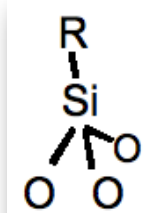
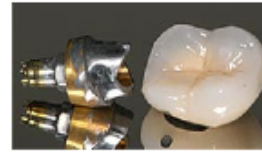
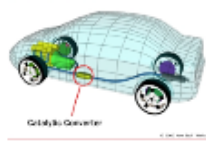
Synthesis  
Processing

### Functionalization

How can we make it?

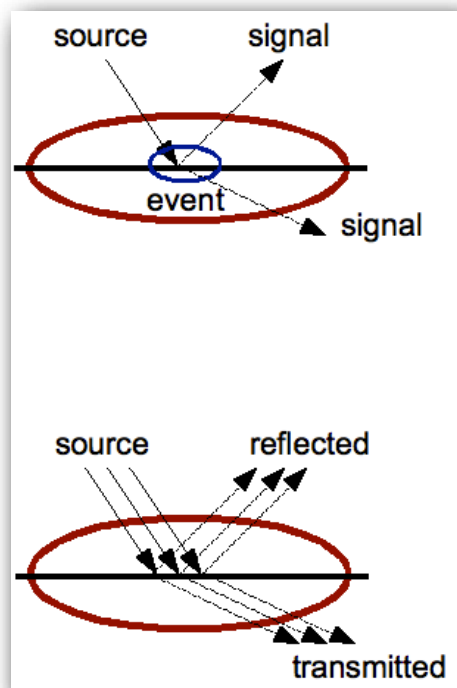
# ▼ Surface Science & Technology

Adhesion    Thin Films    Heterogeneous Catalysis    Corrosion    Biomaterials    Tribology



## ▼ Techniques

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## Chemistry (Spectroscopies)

Auger Electron ... (AES)

Energy Dispersive ... (EDS)

Fourier Transform Infrared ... (FTIR)

Raman ...

X-ray Photoelectron ... (XPS)

## Characterization

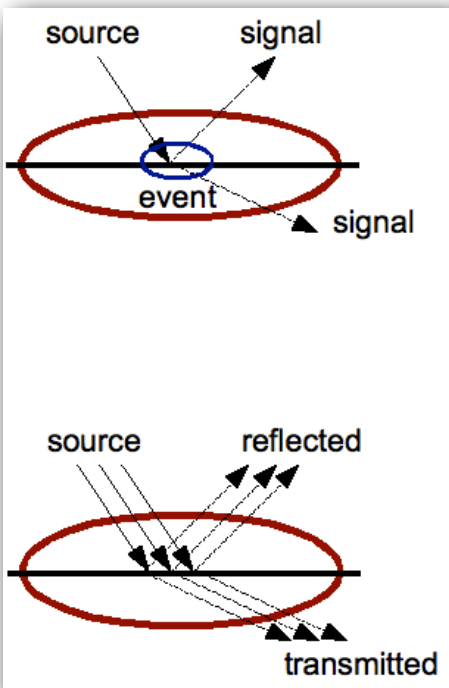
What is in it?

How much is in it?

How are they bonded?

## ▼ Techniques

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### Structure (Microscopy)

Optical ...

Scanning Electron ... (SEM)

Probe Microscopy (AFM, SPM, ...)

Scanning Tunneling ... (STM)

### Structure (Diffraction)

X-ray ... (XRD)

Characterization

How is their arrangement?

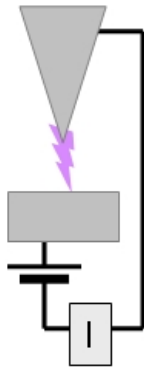


## ▼ Microscopies

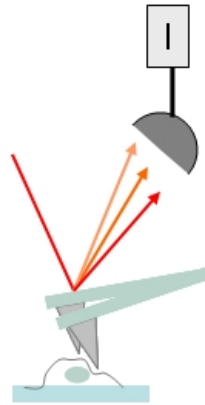
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### Scanning Probe Microscopy (SPM)

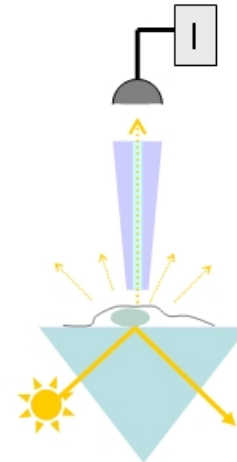
Scanning Tunneling  
Microscopy (STM)



Atomic Force  
Microscopy (AFM)



Scanning Near-field  
Optical Microscopy  
(SNOM)



## ▼ Dimension 3000 (in startup)

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Scanning  
Range

< 100 microns

Resolution

nearly atomic

Modes

contact  
tapping

Special  
Studies

phase contrast  
magnetic force  
thermal imaging

...

## ▼ Nanoscope III (in planning)

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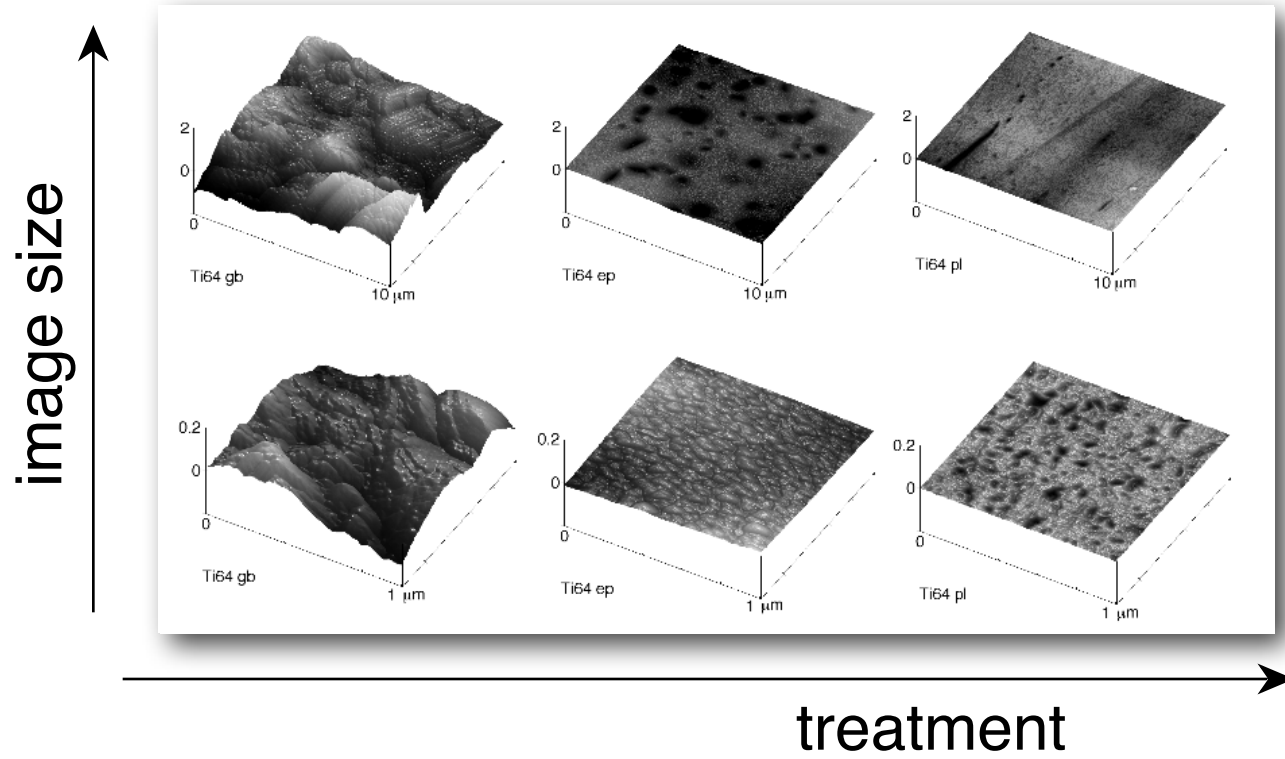
Scanning  
Range      < 100 nm

Resolution      **atomic!**

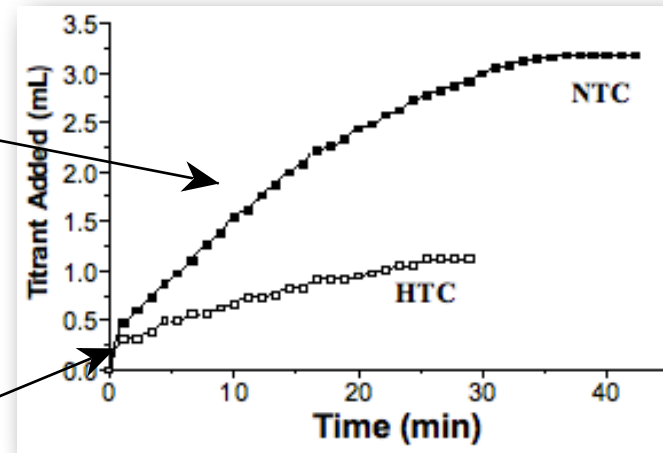
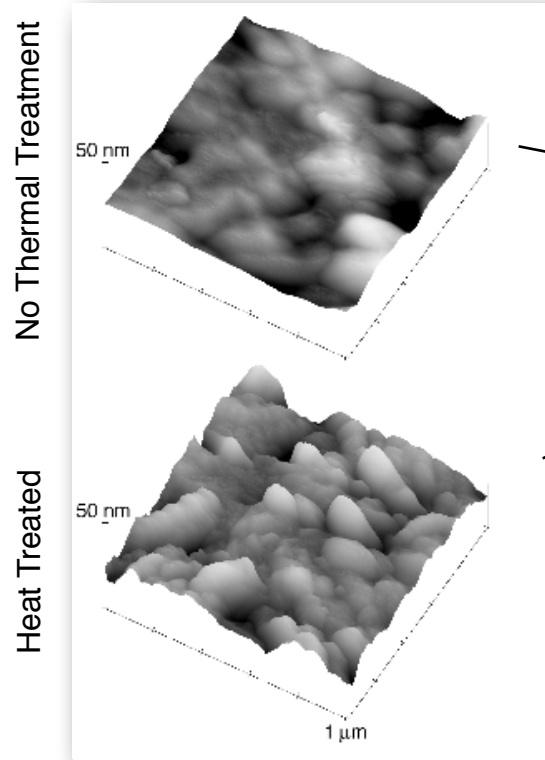
Modes      ...  
**tunneling**

Special  
Studies      ...  
**liquid cells**

# ▼ Surface Roughness



## ▼ Surface Roughness

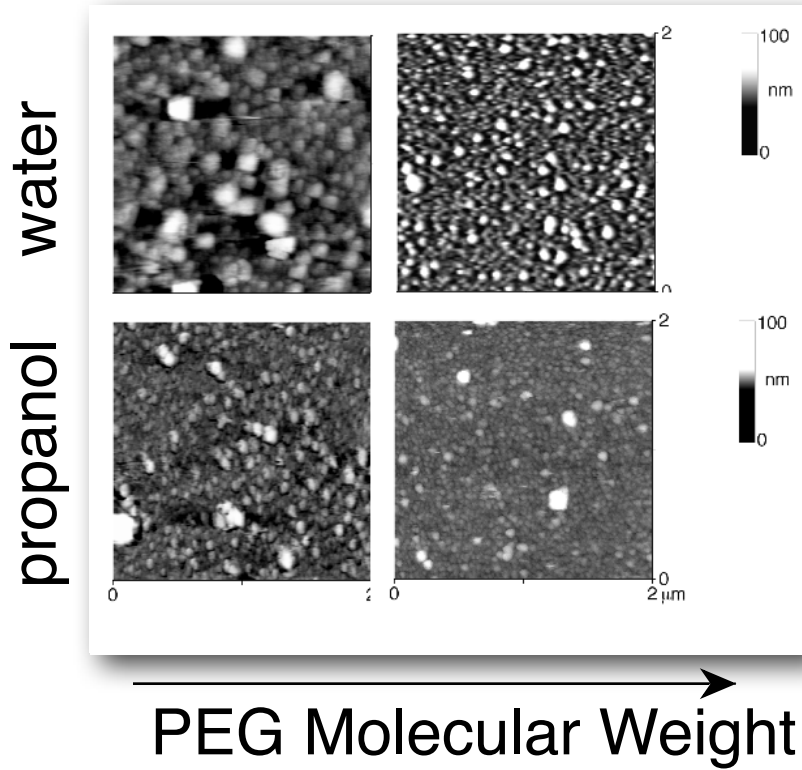


### HTC Coating

- greater surface roughness
- dissolves faster

## ▼ Polymer Agglomeration

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### Problem

Quality of tapping mode image is affected by fluid phase above the surface

Materials Science & Technology

Surface Science & Technology

Materials / Surface Characterization

Thank you!

- Can the fluorescence microscope in Biology Department have any use here? - J Fix
- How much is needed to reconstitute the Nanoscope III? - J Evans
- What about reconstituting the Biorad IR instrument? - K Chittur
- Does any interest exist for using the NMR for solid state? - J Fix
- What is the IR range of the instrument being brought to Chemistry? - J Williams