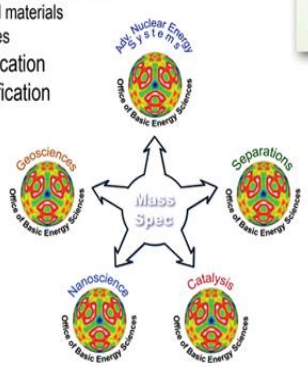
# Seeing the Real World Through Ambient Mass Spectrometry–Based Chemical Imaging

## For Analysis—Why Is Mass Spectrometry So Important?

- Universal Analysis
  - elements
  - organic and inorganic molecules
  - nanostructured materials
  - macromolecules
- Targeted Identification
- Unknown Identification
- High Sensitivity
- High Specificity

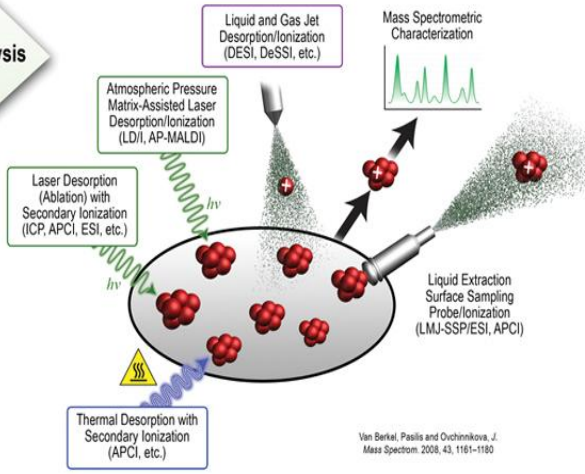



**Addressing the Challenges to Enable Spatially Resolved Molecular Chemical Analysis of Interfaces Under Real World Conditions**

### Scientific Challenges

- Understand the physico-chemical phenomena involved with the various desorption processes
- Dramatically enhance molecular ion yield
- Understand and implement the means to efficiently collect and transport ions at atmospheric pressure

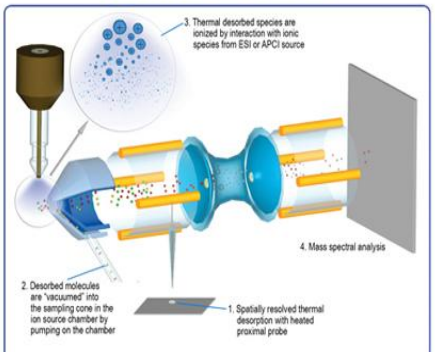
## Atmospheric Pressure Surface Sampling and Ionization Techniques




Van Berkel, Pasilis and Ovchinnikova, J. *Mass Spectrom.* 2008, 43, 1161–1180

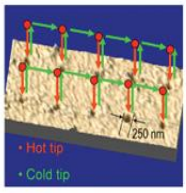
## Molecular Cartography:
### Chemical and Topographical Imaging Using Complementary Multi-Mechanism Techniques

### Proximal Probe Millimeter to Nanometer Spatially Resolved Thermal Desorption Surface Sampling/Ionization

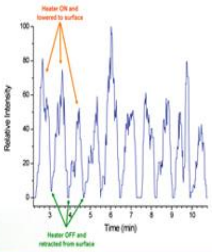



**Combined Surface Topographic and Chemical Information**

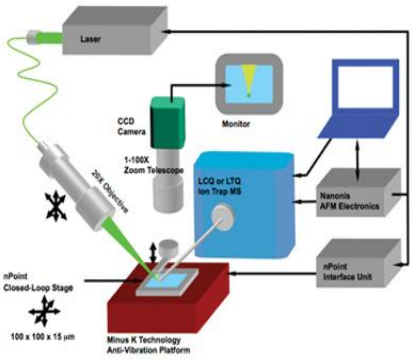
- Atomic Force Microscope (AFM) cantilever used as thermal desorption proximal probe
- 250 nm diameter thermal desorption holes
- Surface imaged with same AFM tip and apparatus



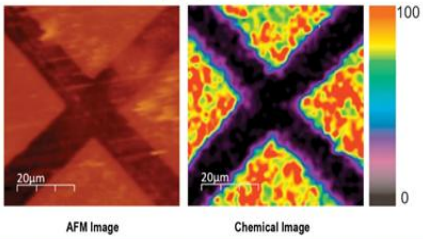
- Corresponding chronogram from SRM of caffeine (m/z 195 –138)

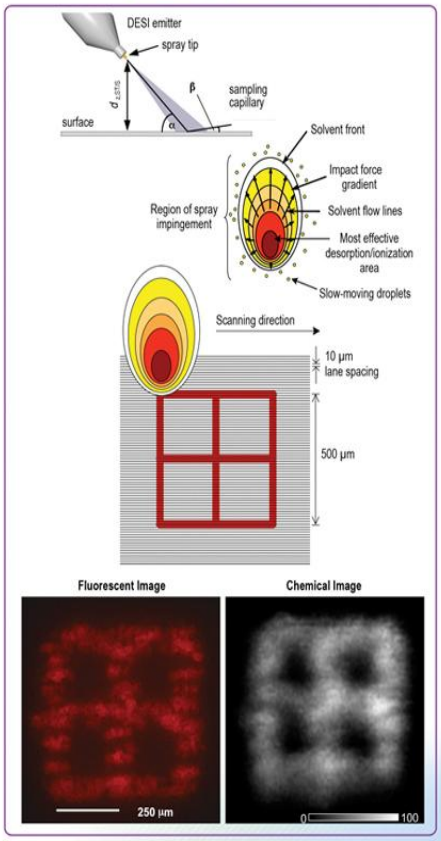



### Combined Topographic and Spatial Chemical Imaging with an AFM-Based Laser Desorption/Ionization Microprobe Mass Spectrometer




**Combined Surface Topographic and Chemical Information**




### Micrometer Scale Chemical Imaging with Desorption Electrospray Ionization