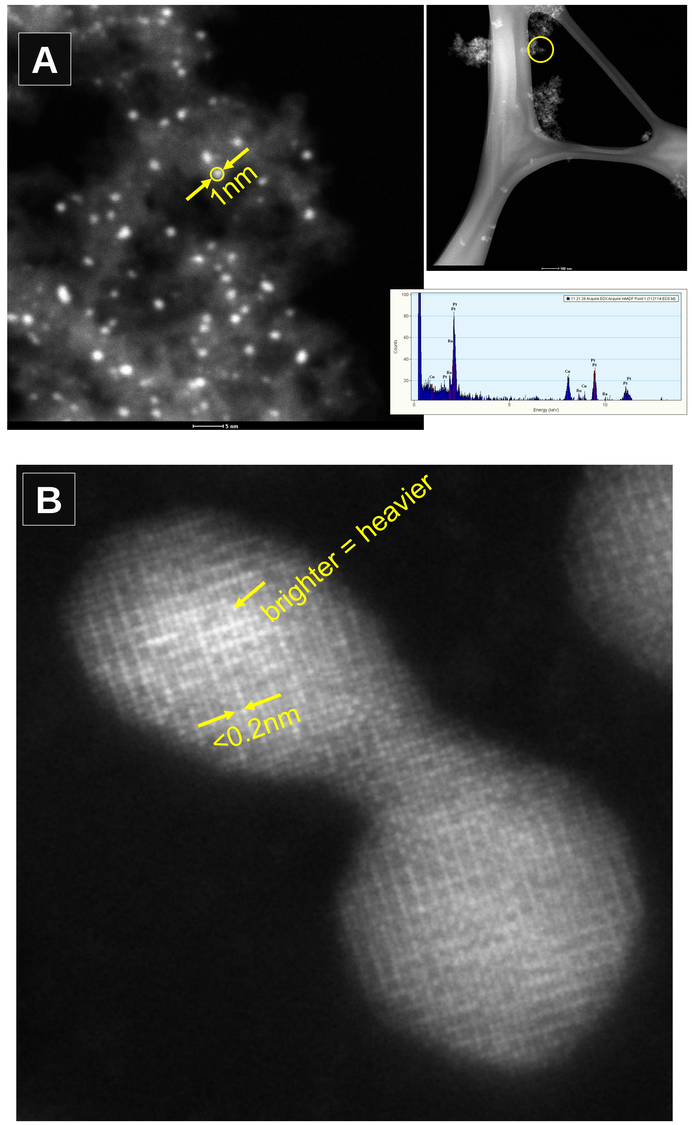
Adaptable 3D Electron Microscopy for Characterizing Nanoscale Materials

More Insight, Faster

- Advanced T3-D TEM can visualize morphology, spatial distributions, crystal structure, and chemistry
- Minimizes “lost count” due to particles overlap, insufficient contrast, and other imaging artifacts
- Provides quantitative and statistically relevant size, spatial distribution by resolving “projection” issue (conventional TEM images were made by projecting a 3D object onto 2D plane)
- Multi-component, non-uniform size industrial materials can be analyzed
- Compatible with most of nanoparticle catalysts on various support materials
- Maximum spatial resolution: 1.3Å for imaging, 5Å for spectroscopy

Industry Significance

- No guessing game – 3D real space reconstruction with crystal structure, orientation, and chemistry information
- Customizable Field of view (area of analysis) – few 10 μm2 to atomic resolution
- Capable of dynamic measurement – Adaptable for in-situ experiments
- Algorithm can be refined to your requirements
- Algorithm reduces the number of images required for 3D reconstruction by 90%. Shortens acquisition time and minimize electron beam irradiation damage



(A) STEM image of a Pt-based alloy nanoparticle catalyst, showing chemistry and spatial/size distributions (B) Atomic resolution STEM image of the Pt-based nanoparticle, showing elemental distribution and crystal structure in nanometer level.

Benefits to Partner

- VT is currently only institution in the US developing this advanced 3D electron microscopy reconstruction technique (competitors: Cambridge and Antwerp)
- We are currently applying this to polymer based materials, and also developing dynamic in-situ measurement techniques (heating/cooling)
- The facility has additional characterization capabilities, i.e., SEM, XPS, Auger, AFM, etc.
- Can engage with expert catalysts researchers on VT campus, ITAR ready

Opportunity

- Seeking mid-term collaboration research partner. We usually focus on fundamental materials science and try to establish a material’s design principle via microstructure-functional property relationships
- Can the capability be applied to solve an industry challenge? Yes, the technique is especially suitable for nanoparticle catalysts (noble and transition metal compounds), and we are experienced collaborating with chemical engineers

Development Status

Static characterization has been used for a NETL-RUA project (heat resistant steel), and other fundamental research including catalysts and nanominerals. Dynamic experiment is under-development.

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