

## **Developing Nano-Characterization Picks and Axes for the Coming Nano-Goldrush**

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The nano-revolution cannot take place without the tools that can measure and characterize processes, products, properties, morphologies, etc., namely, those physical attributes that define the application and benefit of the new product. Even if not used for development, instrumentation is important to define the specification of the product, to set standards of production and processing, to make chemical, mechanical and other physical property guarantees and to establish classifications based on size, structure, chemistry, and morphology.

Since nanotechnology incorporates many fields and many new applications, the common nano-thread connecting them all is the fact that, whatever they are or whatever they do, something very, very small is involved. This implies that instrumentation that studies and characterizes this very, very small nano-world must magnify that world to make it visible and comprehensible.

A wide range of instrumentation currently exists that allows developers and investigators to study the nanoworld and to express the results derived from these studies in a form that is readily useful and understandable. This instrumentation includes: Transmission electron microscopes, Scanning electron microscopes, Auger microprobes, Electron microprobes, SIMS Microscopes, Scanning Probe microscopes, X-ray microscopes, Imaging Atom Probes, and Low Energy Electron Microscopes. New and improved microscope capabilities are constantly being developed to satisfy the requirements of specific experiments or to further express the existing capabilities of established techniques. The variety of scanning probe methods is a good example of the plethora of imaging mechanisms exploited in a single microscope concept.

This presentation will emphasize the current state-of-the-art in instrumentation and discuss the near and far future requirements of nanoimaging and nano-characterization. Fortunately, the technologies needed for most of these tasks today is largely in hand. Thinking ahead to future products and future applications will require new concepts, techniques, and...new instruments.

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