

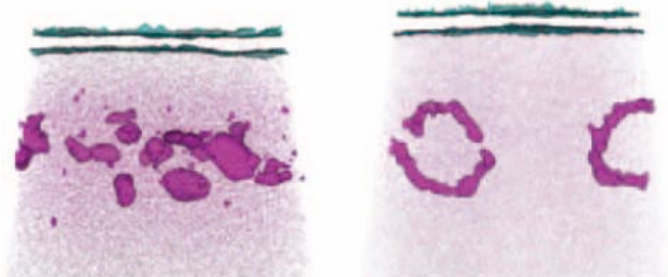
Materials Applications of Atom Probe Tomography

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Atom probe tomography (APT) provides three-dimensional structural and compositional analysis of materials at the atomic scale. Metals and alloys have been studied extensively by this technique for several decades. Recent specimen fabrication techniques, particularly those using focused-ion beam instruments with in-situ manipulation, have made it routine now to extract and analyze specimens from a wide variety of nanoscale structures. The aim of this presentation is firstly to review developments in instrumentation that have enabled major progress and secondly to explore the rich spectrum of applications for a wide variety of materials including advanced alloys, complex electronic devices, dielectric components, and biological materials.



APT image of arsenic dopants (purple) implanted into silicon. (Left) Cluster defects after rapid thermal anneal at 600°C. (Right) Vacancy dislocation loops after drive-in anneal at 1000°C. From: K. Thompson *et al*, *Science* 317 (2007) 1370

A Professor of Materials Science and Engineering at the University of Wisconsin until September 2001, Tom Kelly took a sabbatical and founded a company to commercialize his recently invented Local Electrode Atom Probe (LEAP®) microscope. This technology enables researchers to image and analyze materials such as computer chips at the atomic scale. LEAP technology uses a high electrical field to capture an atom-by-atom "picture" of a material and render that image on a computer screen in 3-D. Thomas F. Kelly received his BS in Mechanical Engineering with highest honors from Northeastern in 1977 and a Ph.D. in Materials Science from MIT in December 1981. After a one year postdoc at MIT he joined the faculty of the Department of Metallurgical and Mineral Engineering of the University of Wisconsin-Madison in January 1983, where he was Director of the Materials Science Center from 1992 to 1999. Kelly was also Founder of Imago Scientific Instruments and its Chief Executive Officer and Chief Technical Officer. In April 2010, Imago was acquired by Ametek, Inc. and was made part of the CAMECA SAS business unit. He has been active in the fields of analytical electron microscopy, atom probe microscopy, rapidly solidified materials, and electronic and superconducting materials for over 30 years. He has published over 160 papers with 19 patents issued and pending in these fields. He is expert in atom probe microscopy and most forms of transmission electron microscopy and has brought innovations to the instrumentation and practice. Tom is currently a Director of the MicroAnalysis Society, the immediate past President of the International Field Emission Society, and recently served a three-year term as Director of the Microscopy Society of America.