

# Convergent Beam Electron Diffraction in Materials Characterization

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## Abstract

Over the past 30 years, convergent beam electron diffraction (CBED) in the transmission electron microscope has developed into a very powerful analytical characterization tool. For example, CBED can be used to quickly and accurately determine the point and space groups of crystalline phases as long as they are of sufficient size to span the thickness of the thin foil. CBED can also be used to make qualitative measurements of the elastic strains that are present in materials due to a variety of sources including differential coefficients of thermal expansion in multiphase materials such as composites or anisotropic thermal expansion coefficients in single phase materials. Unfortunately, the need to make the samples sufficiently thin to be electron transparent usually results in significant relaxations in the sample making such measurements dubious at best. In this presentation, I will highlight the utility of using CBED in materials characterization using various examples including phase identification and “fingerprinting” in complex alloys and strain measurements in both superalloys and silicon. In the case of the latter, I will emphasize some recent CBED measurements of lattice strain in next-generation CMOS devices where strained silicon is one of the primary methods for increasing performance.

## Biographical Sketch

Michael Kaufman is a professor in the MME department and the director of the EM laboratory at the Colorado School of Mines. Prior to joining CSM, he was professor and chair of the Materials Science and Engineering Department at the University of North Texas. Before that, he spent 15 years on the faculty in MSE at the University of Florida. His background is the physical metallurgy of structural materials with an emphasis on characterization using advanced analytical techniques, primarily transmission electron microscopy. He has a BS and a PhD in Metallurgical Engineering from the University of Illinois in Urbana-Champaign.

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