

[Note: This is a reprint of an abstract. Contents of this document should not be quoted or referred to without permission of the author(s).]

Invited seminar, presented at Lehigh University, Bethlehem, Pennsylvania, February 4, 2003

"Seeing the Atoms More Clearly: The Impact of Aberration-Corrected STEM on Materials Science"

Stephen J. Pennycook

Condensed Matter Sciences Division
Oak Ridge National Laboratory
Bldg. 3025M, MS-6030
Oak Ridge, Tennessee 37831-6030

"The submitted manuscript has been authored by a contractor of the U.S. Government under contract No. DE-AC05-00OR22725. Accordingly, the U.S. Government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for U.S. Government purposes."

Prepared by the

CONDENSED MATTER SCIENCES DIVISION
OAK RIDGE NATIONAL LABORATORY
Managed by
UT-BATTELLE, LLC, for the
U.S. DEPARTMENT OF ENERGY
Under Contract DE-AC05-00OR22725

February 2003

"Seeing the Atoms More Clearly: The Impact of Aberration-Corrected STEM on Materials Science"

S. J. PENNYCOOK

Condensed Matter Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN

Aberration-correction is currently one of the most exciting developments in electron microscopy, doubling the achievable resolution in a period of weeks rather than years. Besides improved resolution, images show better contrast and signal to noise ratio, providing sensitivity to single impurity or dopant atoms. Improved analytical sensitivity is also available, promising to open up many areas in materials science. Such data is ideally complemented by first-principles theory which gives insight into atomic configurations and energetics. Two aberration correctors are presently installed at Oak Ridge National Laboratory, and examples will be presented from nanoscience, semiconductors, ceramics and catalysis. Future prospects for single atom analysis and three-dimensional atomic-resolution tomography will be discussed.

Biographical Sketch

Stephen J. Pennycook is a Corporate Fellow in the Condensed Matter Sciences Division at Oak Ridge National Laboratory and leader of the Electron Microscopy Group. He obtained his PhD from the University of Cambridge and has given over 100 invited presentations at international conferences. He has over 400 publications, including 35 in *Science*, *Nature* or *Physical Review Letters*, 15 book chapters and 3 encyclopedia articles. He is a Fellow of the American Institute of Physics, the Institute of Physics (London), and recipient of the Materials Research Society Medal, the Thomas Young Medal of the Institute of Physics, and the Heinrich Award of the Microbeam Analysis Society.