Theory and Applications of SEM/FIB DualBeam Instrumentation

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The basic concepts of ion-solid interactions and focused ion beam (FIB) instrumentation and theory will be presented. Ion induced secondary electron and secondary ion imaging will be compared. Examples of basic FIB milling and the uses of gases for chemical vapor deposition and gas enhanced etching will be given. The applications of FIB and DualBeam usage on multiple material systems in numerous industries have been realized, and examples of FIB milling for many material systems will be shown. Uses of the DualBeam platform for nanotechnology applications will be described, showing that the utilization of such a tool is limited only by one's imagination. FIB milling techniques for specimen preparation for scanning electron microscopy (SEM), transmission electron microscopy (TEM), and other analytical tools will be presented. In particular, the ex-situ lift-out and in-situ lift-out TEM techniques will be presented in detail, and the applications of these specimen preparation methods for many TEM and Scanning TEM techniques will be emphasized. The concepts and advantages of a dual platform FIB and scanning electron microscope (SEM) will be discussed. In particular, the development of the combined FIB/SEM DualBeam instrumentation as a nano-lab and a 3D characterization tool which including microstructure, elemental composition, and crystallographic information will be given. Examples of using the DualBeam as a 30 keV scanning transmission electron microscope will also be presented.

Brief Bio:

Lucille A. Giannuzzi received her B.E. and M.S. degrees from SUNY Stony Brook, and her Ph.D. degree from The Pennsylvania State University. She recently joined FEI Company as a field product marketing engineer for FIB/Dual Beam systems. Dr. Giannuzzi maintains her affiliation with the University of Central Florida as Professor of Mechanical Materials & Aerospace Engineering where her primary research interests have included ion/solid interactions and the microstructural evaluation of materials using focused ion beams and transmission electron microscopy. She is on the editorial board of the journal, Microscopy and Microanalysis. She is active in AVS, the Chair of the MSA sponsored FIB focused interest group, and on the board of MAS. She has been a local affiliate speaker for both MSA and the MAS and is co-editor of an upcoming FIB book.