# Advanced S/TEM Sample Preparation Using $Xe^+$ PFIB

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In the past 5 years $Xe^+$ plasma focused ion beam (PFIB) has gained much traction for large-area 3-dimensional characterization, large area delayering or deprocessing and for preparation of samples for mechanical testing because PFIB systems offer increased milling rates due mostly to its ability to deliver up to 40X more current over $Ga^+$ LMIS FIB systems [1]. Additionally, micro- and nanomachining of diamond using PFIB continues to generate interest in applications such as diamond anvil cells, photonic devices, micro-cantilevers and tools for imprinting applications [2,3]. However, researchers require an instrument that can also be used in applications where FIBs and FIB-SEMs have largely been successful such as S/TEM sample preparation, atom probe sample preparation and circuit edit. Therefore, it is of interest to characterize the quality of thin specimens prepared for S/TEM systems and to understand if the process of preparing thin sections by FIB requires different techniques during the thinning process.

Recently, FIB damage studies using Xe+ PFIB in silicon reveal that the damage layer is 35-40% smaller for the PFIB in the accelerating voltage range of 5-30 kV when compared with $Ga^+$ FIB sample preparation [4]. S/TEM samples of GaAs and an Al/Si interface were prepared by PFIB using a Helios PFIB DualBeam™ and by Ga+ FIB using either a Scios DualBeam or Helios NanoLab DualBeam. After preparation, the samples were immediately analyzed in probe-corrected 300 keV TEMs to evaluate the quality and thinness of the specimens.

This discussion will review the sample preparation technique using a PFIB and compare S/TEM results of each sample as prepared by $Xe^+$ PFIB or $Ga^+$ FIB.

References:

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