Aberration-corrected S/TEM methods as ultra-precise tools in materials characterisation at the atomic scale

Magnus Garbrecht[1]
[1]*Australian Centre for Microscopy & Microanalysis, The University of Sydney, NSW 2006, Australia;*
e: magnus.garbrecht@sydney.edu.au

Sophisticated aberration-corrected high-resolution transmission electron microscopy (HRTEM) imaging and spectroscopy methods are nowadays commonly applied for investigations of materials systems at the atomic level. A brief recapitulation on the development of such instruments and the methods that became available with them will be given in the first part of the presentation.

Secondly, the application of such methods during the study of thin film nitride superlattices for coating and electronic applications will be demonstrated. Here, fundamental insights into diffusion processes were gained directly from atomic level imaging with the help of aberration-corrected scanning TEM and energy-dispersive X-ray spectroscopy methods. The onset and progression of dislocation-pipe diffusion under sequential annealing could be studied at direct atomic resolution for the first time. Those results demonstrate that dislocation-pipe diffusion can be independent of concentration gradients in the system but is governed by the reduction of strain fields in the lattice.

All results shown were recorded with an image- and probe-corrected and monochromated FEI 60-300 kV instrument equipped with a high-brightness XFEG source, Quantum GiF & Dual EELS system, and Super-X EDS detectors for ultra-high count rates.