東京大学グローバルCOEプログラム　機械システム・イノベーション国際拠点

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# In-Situ TEM: From High Spatial Resolution to High Temporal Resolution


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## 要旨


The last few years have seen a paradigm change in (scanning) transmission electron microscopy with unprecedented improvements in spatial, spectroscopic and temporal resolution being realized by aberration correctors, monochromators and pulsed photoemission sources. Spatial resolution now extends to the sub-angstrom level, spectroscopic resolution into the sub-100meV regime and temporal resolution for single shot imaging is now on the nanosecond scale. However, to fully utilize these instrumentation developments to study both structures and processes, in-situ stages to control the environment around the sample must also be employed. In this presentation, the development and implementation of two environmental stages will be discussed. An in-situ gas stage has been developed in collaboration with Fischione Instruments that allows atmospheric pressure in a range of reactive gases to be maintained around the sample while atomic resolution images are obtained. By utilizing a novel laser heating source, temperatures up to 2000$^{o}$C can also be obtained in small areas of the sample. Such capabilities allow for direct imaging of oxidation and reduction processes in metals, ceramics and catalytic systems. An in-situ liquid stage has been developed in collaboration with Hummingbird that allows atomic scale images and electron energy loss spectra to be obtained from samples suspended in solution. This has a wide range of applications to studying corrosion in materials science and also to studying live biological systems. These stages have been designed to be incorporated into both high spatial resolution aberration corrected (S)TEM as well as into high temporal resolution Dynamic TEM (DTEM). In addition to describing recent results on both of these types of microscopes, the potential for future experiments will also be discussed.



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