

JEOL

Latest TEM developments from JEOL

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The nanoworld: where individual atoms that constitute substances are directly observed. A TEM equipped with Cold-FEG (Cold Field Emission Gun) realizes this dream. With Cold-FEG, a superb high-quality electron beam is produced that achieved a narrower spread and forms a sharper probe with higher brightness than a conventional Schottky FEG. Many improvements have been developed for the conception of the ARM200F.

The ARM200F receives a new design allowing the improvement of the mechanical, electrical stability and the protection against environmental disturbances. Furthermore, the base frame has been designed to the optimum geometry for the accommodation of double TEM/STEM Cs correctors totally integrated. The use of a spherical aberration corrector for electron optic system as standard, has achieved a scanning transmission image (STEM-HAADF) resolution of 0.078 nm, the highest in the world among the commercial transmission electron microscopes.

These improvements coupled with Cold-FEG allow the ARM to perform high level studies for all TEM techniques (HRTEM, HRTEM, EELS, EDS, Annular Bright Field, diffraction ...). Furthermore, the ARM200F equipped with Cold-FEG and the new Centurio EDS detector (solid angle 1 sr) allows the acquisition of atomic resolution EDS mapping (Figure 1).

Example of application: the use of a Cold-FEG dramatically improves EELS energy resolution. As seen figure 2, the energy resolution is about 0.3eV for a Cold-FEG. This very good energy resolution is a major factor for EELS studies; in particular ELNES (Energy Loss Near Edge Structure) exhibits a characteristic shape depending on the chemical bonding states in a substance. Figure 2 is an example of rutile and anatase analysis.

JEOL offers “Ultra-high resolution” with this next generation of “improved Cold-FEG”.

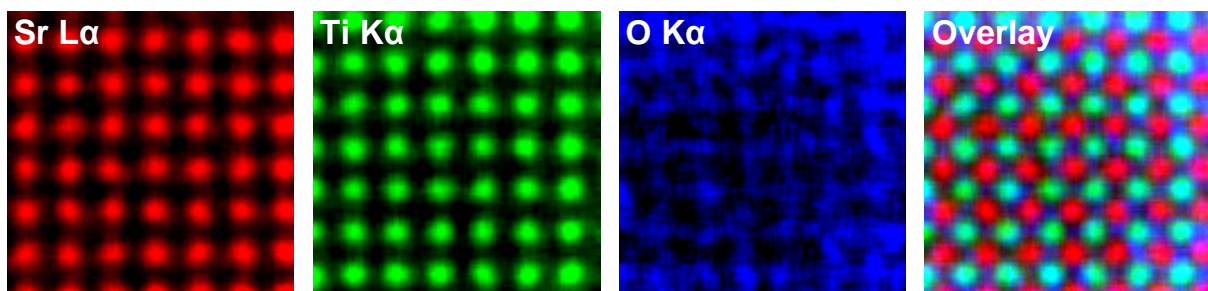


Figure 1: Atomic resolution EDS mapping on SrTiO₃ sample.

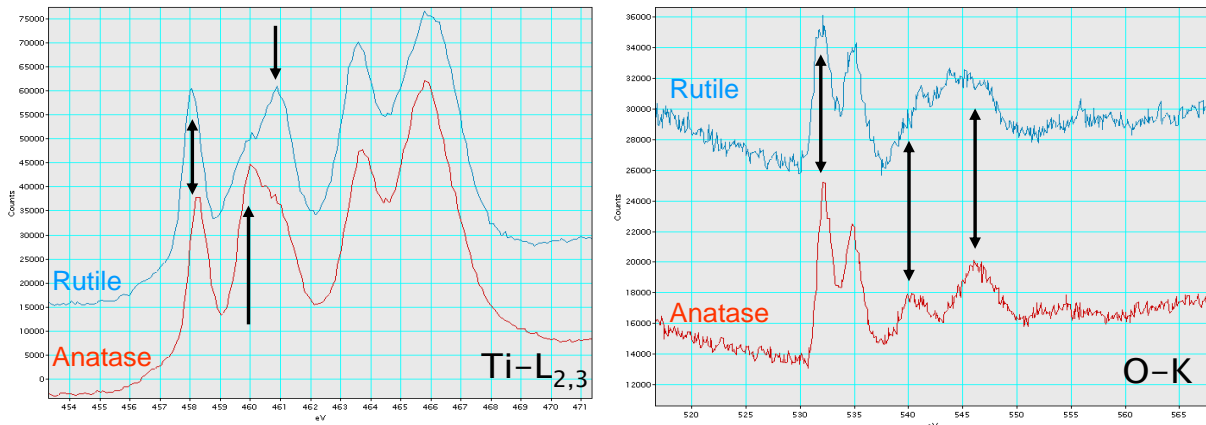


Figure 2: EELS spectra of rutile and anatase type crystal, which show ELNES obtained from the O-K edge and the Ti-L edge, reveal clear differences in chemical bonding states (indicated by arrows). The higher energy resolution of a Cold-FEG enables clear observation of these differences.