RISE Microscopy

Correlative microscopy on a new level – Complementing ultra-structural SEM with molecular Raman imaging

ApplicAtions

- carbon
- plagioclase (feldspar)
-apatite

RISE Microscopy is well suited for ...

- Raman newcomers as they will benefit from the intuitive user interface and straighter measurement procedure.
- Experienced users as they will appreciate the exceptional correlative microscope performance encompassing the advantages of both techniques in one instrument.

Raman Imaging and Scanning Electron Microscopy

Principle of RISE Microscopy

For RISE microscopy samples are automatically transferred from one measuring position to the other within the vacuum chamber of the SEM for the entirety of the measurement procedure, thus streamlining the workflow and drastically improving the instrument’s ease of use. The beampath of the Raman microscope is shown in light green.
**The Raman Principle**

- Raman spectroscopy is a non-destructive method to analyze the chemical composition of a sample.
- A Raman spectrum is the result of inelastic scattering of light from a molecule.
- A Raman spectrum shows the energy shift of the excitation light upon interaction with the sample.

**Raman Imaging**

- Raman imaging is a method to obtain an image of a sample based on the Raman spectrum of each pixel.
- Each molecule and chemical compound results in a specific Raman spectrum, which can be easily identified by its unique Raman ‘fingerprint’.

**Additional sample information from the Raman spectrum:**
- a. Peak intensity: Quantity/amount of a specific compound
- b. Peak shift: Identification of stress and strain states
- c. Peak width: Degree of crystallinity
- d. Polarization state: Crystal symmetry and orientation

**Applications**

- Raman spectral imaging of a sample area.
- Raman imaging of a geological sample area.
- Raman spectral imaging of a sample area.

**Confoical Raman Imaging**

- High-resolution Raman imaging provides the ability to see structures within the sample.
- The WITec confocal Raman microscopy and imaging system combines Raman spectroscopy with confocal microscopy and enables confocal Raman imaging with the information of a complete Raman spectrum at every image pixel and a lateral resolution at the diffraction limit.

**RISE Microscopy — The Instrument**

- RISE microscopy is a combination of SEM and Raman spectroscopy.
- A RISE microscope combines the Raman microscope and SEM into a single instrument.
- RISE imaging combines the high spatial resolution of SEM with the chemical information of Raman spectroscopy.

**RISE Analysis of a Lithium-ion Battery Structure Consisting of Anode Material Along with a Tri-layered Polymeric Separator and a Mineral Phase.**

- a) Color-coded Raman-SEM image of anode material along with tri-layered polymeric separator and mineral phase.
- b) The corresponding SEM image of lithium-ion battery structure.
- c) The Raman spectrum of the lithium-ion battery structure.

**RISE Microscopy Done with SEMs from:**

- a) Raman spectral imaging of a sample area.
- b) The corresponding SEM image of anode material along with tri-layered polymeric separator and mineral phase.
- c) RISE microscopy analysis of a lithium-ion battery structure consisting of anode material along with a tri-layered polymeric separator and mineral phase.