T16. Confocal Raman Microscopy - CERTH

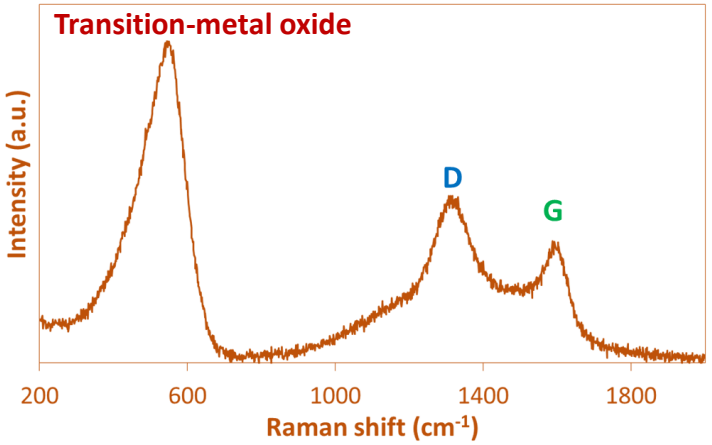
TEESMAT
Open Innovation Test Bed for Electrochemical Energy Storage Materials

How it works:

MicroRaman spectroscopy is a non-destructive technique that utilizes the interaction of a monochromatic light with matter providing a spectrum characteristic of the specific vibrations of a molecule. This technique enables the ex-situ and real-time in-situ characterization of 2D areas and 3D volumes and by combining three excitation sources (325nm, 532nm and 785nm), it has the potential to create high quality Raman data.

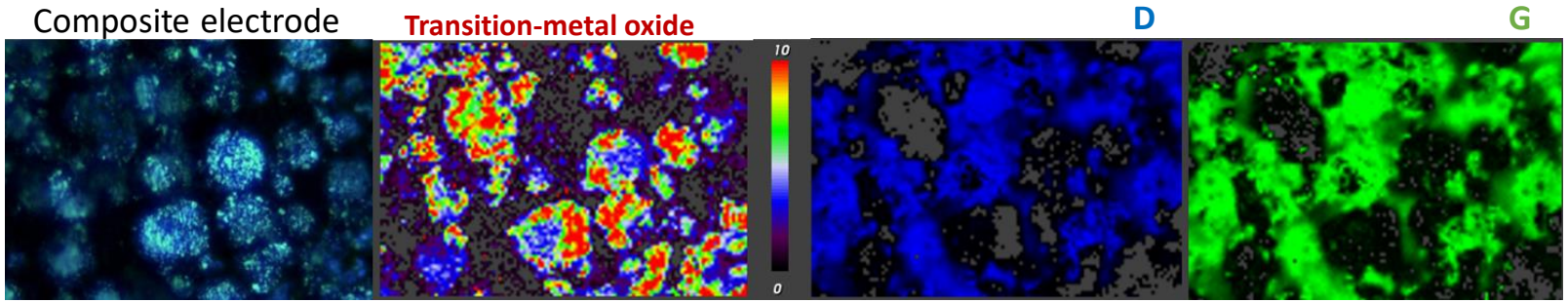
What can be seen: Two kinds of measurements can be acquired, Single-point and Raman images.

- Single-point measurements reveal chemical structure and identity



Raman spectrum of composite electrode

- High quality Raman images depict the spatial variation of Raman data and reveal information about material concentration and spatial distribution, molecular structure and phase transformations, material strain/stress, state of charge uniformity at the oxide particles' surface.



40 μm x 60 μm Raman microscope intensity images of the composite electrode. The images were collected at 0.5 μm resolution. Each Raman image corresponds to the relative band intensities of electrode material, D and G carbon bands of each spectrum.

T16. Confocal Raman Microscopy - CERTH

TEESMAT
Open Innovation Test Bed for Electrochemical Energy Storage Materials

What kind of sample:

The use of a Raman-compatible electrochemical cell can provide intrinsic information on battery aging and the dynamic nature of the solid electrolyte interfaces on real time cycling and at various voltammetries.

Test cell for optical with face-to-face arrangement of electrodes

Test cell for optical characterization of gas diffusion electrodes in metal-air batteries.

All material types relevant to batteries can be analyzed

- Crystalline and amorphous, organic and inorganic
- Large volumes or minute traces of materials with very weak Raman signal
- Uneven, curved or rough surfaces can be mapped utilizing the live automated focus tracking technology which maintains focus in Raman mode.

Why is it useful:

Raman spectroscopy is useful for studies throughout the battery development process. Ex-situ, in-situ and operando measurement are performed to generate information on materials homogeneity and stoichiometry on the micrometer scale.

Investigation time-scale : days

Maturity level : advanced