T16. Confocal Raman Microscopy - CERTH

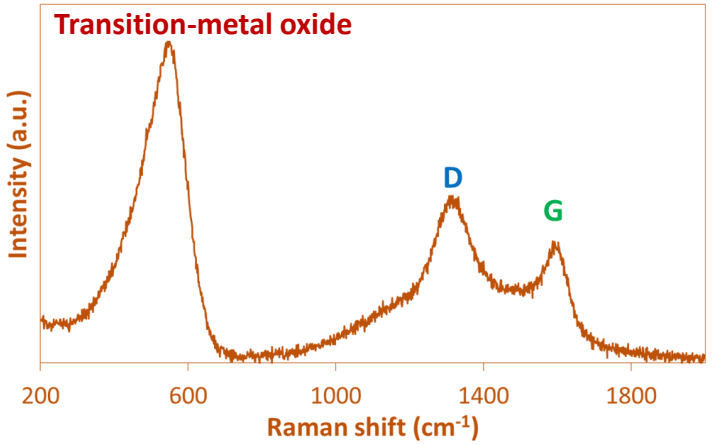
TEESMAT
Open Innovation Test Bed for Electrochemical Energy Storage Materials

How it works:

MicroRaman spectroscopy is a non-destructive technique based on the interaction of 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. Combining three excitation sources (325nm, 532nm and 785nm) can create high-quality Raman data.

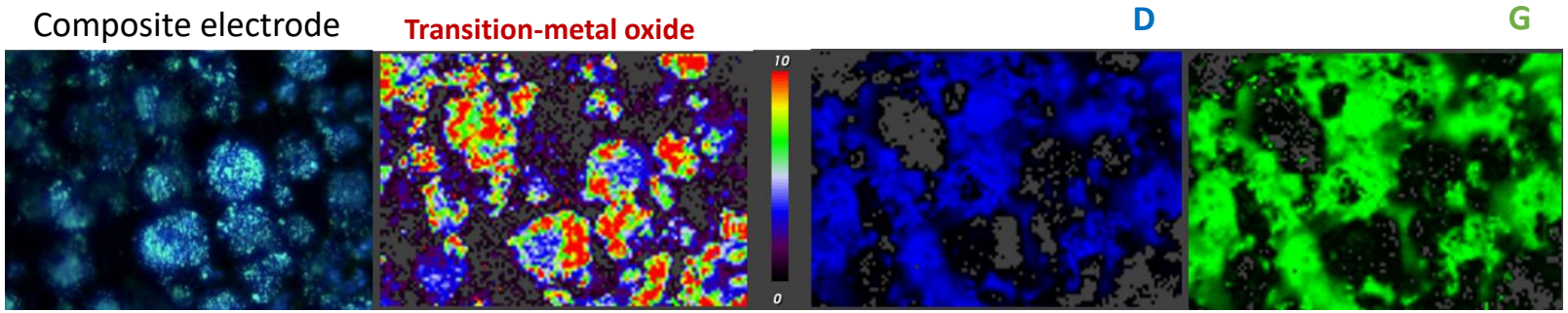
What can be seen: Two kinds of measurements can be acquired, Single-point and Raman images.

- 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 the material concentration and spatial distribution, molecular structure and phase transformations, material strain/stress and state of charge uniformity at the oxide particles' surface.



40 µm x 60 µm Raman microscope intensity images of a 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.

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What kind of sample:

Using a Raman-compatible electrochemical cell can provide intrinsic information on battery ageing and the dynamic nature of the solid electrolyte interfaces in real-time cycling and at various voltammetry.

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 measurements are performed to generate information on materials homogeneity and stoichiometry at the micrometre scale.

Investigation time-scale : days to weeks depending on type of request

Maturity level : advanced