Contribution ID: **113** Type: **Poster Presentation**

Confocal Raman and AFM Characterization of Mesoporous Titania Electrode Substrates for Perovskite Solar Cell Applications

Tuesday, 4 July 2023 15:59 (1 minute)

Confocal microscopy is a technique of choice for high resolution imaging of a wide range of sample surfaces. It also plays a vital role in the optical sectioning of imaged materials for 3D reconstruction. Similarly, atomic force microscope (AFM) is renowned for its capability in evaluating the local properties of different samples precisely down to atomic scale. The amalgamation of AFM with Raman spectroscopy is beneficial in supplying a more comprehensive information on the material properties, in addition to providing ultra-high resolution micrographs of various samples ranging from silicon, fullerenes, polymers, composites, perovskites and many others. Perovskite materials exhibit specific characteristics that distinguish them from other solar cell materials such as low excitonic binding energy, ferroelectric properties, high dielectric constant and absorption coefficient etc. These properties have enabled perovskite solar cells (PSCs) to be renowned as promising alternative technology for silicon-based photovoltaic technology. Intensified efforts are made to improve the stability and commercialization of PSCs through the integration of optimizing additives, effective electron transporting material (ETL) and hole transporting material (HTL) in the perovskite material. In the present work, the interfacial physical properties of mesoporous titania electrode substrates and information on the depth profiles of embedded structures were investigated for prospective applications in perovskite solar cells. This was achieved by obtaining mapped 2D Raman images of specific surfaces on the mesoporous titania electrode and comparing them with their respective morphological information which was extracted through tapping mode AFM technique. Results contained in this work are aimed at improving understanding of the material properties through visualization of both chemical and structural information over a defined area of interest on the sample. The relationship between phase transitions as derived from the micrographs is expected to provide vital interpretation on chemical activities in the mesoporous substrates.

Apply to be considered for a student ; award (Yes / No)?

No

Level for award;(Hons, MSc, PhD, N/A)?

N/A

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Session Classification: Poster Session 1

Track Classification: Track A - Physics of Condensed Matter and Materials