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In-situ and ex-situ IR spectroelectrochemical characterisation of CeVO₄ thin films for counter-electrodes in EC devices

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ABSTRACT

The spectroelectrochemical techniques, combining electrochemical and optical characterisation of samples, significantly contributed to the developments in electrochemical science, especially the investigations of various adsorbed species on the electrolyte|electrode interface, the assessment of the intercalation/deintercalation processes of thin electrochromic films^[1] and various intercalation materials important for lithium batteries. In this study, CeVO₄ films^[2] with intercalation properties were prepared by using a modified peroxy route and their characterisation using *in-situ* and *ex-situ* IR reflection-absorption and *ex-situ* IR transmission spectroelectrochemical measurements enabled the comparison of advantages and disadvantages of these techniques, as well their comparison with *ex-situ* X-ray diffraction spectra. Transmission IR measurements (TO modes) confirmed the formation of tetragonal crystalline CeVO₄ structure with the appearance of two ν_3 TO modes, sharp E_u band at 768 cm⁻¹ (LO counterpart at 912 cm⁻¹) and shoulder A_{2u} band at 840 cm⁻¹. The weak band at 444 cm⁻¹ was a ν_4 (E_u + A_{2u}) deformational mode. The optical response below 5%T was detected using UV-visible spectroelectrochemical technique, revealing also the charge densities from -12 to -20 mC/cm², depending on preparation conditions. Electrochemical impedance spectroscopy was applied for the investigation of electrolyte|counter electrode film interface properties.

REFERENCES

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