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## A Lock-in-Amplifier system for performing Intensity Modulated Photovoltage Spectroscopy measurement in photoelectrochemical cells, tested on TiO<sub>2</sub> thin films

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A system for measuring Intensity Modulated Photovoltage Spectroscopy (IMVS) data on photoelectrodes was built utilizing a standard laboratory lock-in amplifier. IMVS measurement was performed on TiO<sub>2</sub> thin film photoanodes under UV illumination to determine recombination time for electrons and holes, and charge transfer efficiency at the photoelectrode/electrolyte interface. Results from the lab-built device were compared with electrochemical impedance spectroscopy (EIS) data obtained using a commercial electrochemical analyzer, and are discussed with relation to the crystallinity, conductivity, and mobility of charge carriers within the thin films. Finally, the electronic transfer function for the lab-built system is shown to be constant in the frequency range of interest, from 1 Hz to 100 kHz.

### Academic year

5th year and/or beyond

### Research Advisor

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