

PÔSTER - RESUMO - DISPOSITIVOS ELETRÔNICOS, ELETROQUÍMICOS,  
SUPERCAPACITORES E BATERIAS

**URBACH ENERGY: FILM PROCESSING AND THICKNESS EFFECTS**

*Marleane Maria Felix De Azevedo (marleaneaz@gmail.com)*

*Endel Ezequiel Carvalho Costa (ezequielendel6@gmail.com)*

*Guilherme Severino Mendes De Araújo (g19gsma@gmail.com)*

*Kayla Manuelli Pimentel De Carvalho (kaylamanuellicarvalho@ufpi.edu.br)*

*Cleânio Da Luz Lima; Ufpi (cleanio@ufpi.edu.br)*

*Angel Alberto Hidalgo (angel@ufpi.edu.br)*

*Maria Leticia Vega (marialeticia.vega@ufpi.edu.br)*

Understanding how structural order, aggregation, and vibrational coupling influence the optical and electronic properties of conjugated polymers is essential for optimizing their performance in optoelectronic devices. Here, we compare partially ordered MEH-PPV films prepared by the Langmuir–Blodgett (LB) technique with structurally disordered films obtained by drop-casting, as well as with the polymer in solution. UV–Vis absorption, steady-state photoluminescence, polarized spectroscopy, Raman scattering, and charge-transport measurements were employed. In solution, variations in the optical gap and Urbach tail with concentration reveal early aggregation effects manifested in the absorption tail prior to significant perturbation of the conjugated backbone. LB films exhibit partial orientational order, confirmed by absorption dichroism and polarized emission, whereas drop-cast films show

similar optical response in perpendicular directions. Despite this orientational order, LB films show similar Urbach energies parallel and perpendicular to the dipping direction, indicating that the optical defect distribution is not direction-dependent, although a clear thickness dependence reveals the role of interface effects. Vibronic analysis (Huang–Rhys factor and effective conjugation length) demonstrates that LB deposition preferentially aligns polymer backbones with longer conjugation lengths and modifies the dominant vibrational modes coupled to emission, in agreement with Raman spectroscopy. Electrical current density vs. electric field measurements further distinguishes the two morphologies: partially ordered LB devices exhibit smoother and more stable transitions between ohmic and space-charge-limited current (SCLC), whereas disordered drop-cast devices reach the TFLC regime at lower fields, indicating a lower trap density distributed over a broader energy range. The comparison between optical (Urbach) and electrical (TFLC) analyses confirms that shallow optical traps and deep electrical traps probe distinct disorder populations.

Acknowledgments: the Brazilian National Council for Scientific and Technological Development (CNPq) process number: 408449/2024-1, 420515/2023–2, 315710/2023–3, and 314034/2023–4; Fundação de Amparo à Pesquisa do Piauí (FAPEPI), Universidade Federal do Piauí (UFPI), Fundação de Amparo à Pesquisa de São Paulo (FAPESP), Financiadora de Estudos e Projetos (FINPI)

Palavras-chave: urbach energy; langmuir-blodgett; deep traps; shallow traps.