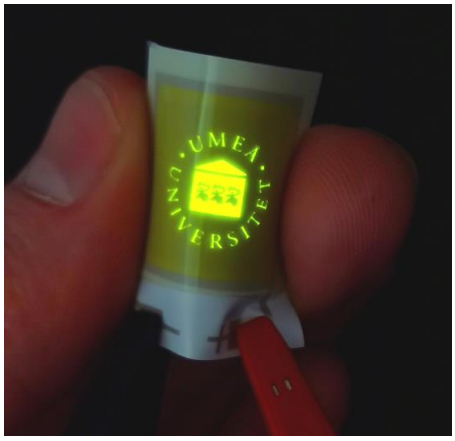
The Next Generation of Light-emitting Devices

Project description



A spray and screen-printed LEC with the Umeå University logo as emission pattern.

At the Organic Photonics and Electronics Group (OPEG), Umeå University, we develop the next generation light emission technology: Light-emitting Electrochemical Cells, or LEC for short. By combining organic semiconductors with mobile ions in specific ways, we can steer the natural reorganization of ions inside a single active layer during operation into a complex internal pn-doping structure that requires multi-layer structures and advanced processing to achieve with LEDs and OLEDs. Using this advantage, we have developed an LEC fabrication process based on spray and screen-printing that results in a very thin and flexible device structure with patternable light-emission (see figure). In this master's thesis project, you will become part of an ongoing applied research project with a clear connection to industry. The overall goal is to advance LEC technology toward practical and useful applications, while gaining hands-on experience in materials, device fabrication, and experimental evaluation within an active research environment.

Choose between two research directions; no prior experience with LECs is needed:

Track A — Development of Inkjet-printed LECs

Digital inkjet printing allows for uniquely customized emission patterns together with low-cost and material- and energy-efficient manufacturing. This track aims to understand the link between material selection, ink formulation, thin-film deposition and the resulting device performance, and is suitable for students interested in device physics and manufacturing techniques.

Track B — Development of an Advanced Experimental Setup

Each potential LEC application requires specific mechanical and thermal device robustness. This track aims to test the limits of our LEC technology in terms of mechanical and temperature stress. You will design, build and use advanced experimental setups to apply mechanical and thermal stress to printed LEC devices and measure their optical and electrical response. This track is therefore suitable for students interested in device physics and mechatronics.

Research group/environment

The project is hosted by the Organic Photonics and Electronics Group (OPEG) at the Department of Physics, Umeå University, a group of 12+ researchers working on sustainable organic electronics and photonics within the WISE framework.

To be conducted at: Department of Physics, Organic Photonics and Electronics Group

Level: A (Master, 30/45/60 hp/ECTS depending on program)

Examiner: Ludvig Edman

Supervisor: Christian Larsen

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