

**ICB PhD public presentations****LASER-PYROLYZED GRAPHENIC PAPER: TOWARDS SMART ELECTROCHEMICAL DIAGNOSTIC TESTS****Léonard Bezinge**

ICB / deMello group and Shih group  
Supervisors: Prof. Dr. Chih-Jen Shih and  
Prof. Dr. Andrew deMello  
Co-examiner: Dr. Emmanuel Delamarche



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**ETH Hönggerberg, HCI J 6 and on Zoom**  
(Zoom ID: 670-9756-8305)

**Project Summary:** Paper-based microfluidics has emerged as a versatile platform for rapid, low-cost point-of-care diagnostic tests. The integration of electronic components into these tests opens up new device functionalities and facilitates the development of quantitative assays. Unfortunately, conventional electrode fabrication methods often impede capillary flow, limiting possible design architectures. We have introduced a platform that uses laser-induced pyrolysis of cellulose paper to create graphenic electrodes seamlessly embedded in the paper matrix, patterned using only a commercial laser engraver. The resulting porous electrodes not only exhibit high conductivity and electrochemical activity, but also retain the wetting properties essential for capillary transport. The unique properties of these laser-pyrolyzed electrodes enable their integration into devices with various flow configurations. Notably, we have developed a vertical flow electrochemical immunoassay for antibody serology or nucleic acid detection, and a flow injection analyzer for high-throughput analysis of small molecules or enzymes in biological samples. Moreover, placing the permeable electrochemical sensor at the core of these capillary-driven devices enables the development of smart tests that can continuously monitor assays and guide users through the testing process.

**CV.** Léonard received his B.Sc. and M.Sc. in Chemical and Bioengineering from ETH Zürich. Following a research internship at the London Centre for Nanotechnology, he joined the research groups of Prof. Chih-Jen Shih and Prof. Andrew deMello at the Institute for Chemical and Bioengineering at ETH Zürich in 2019 to pursue his Ph.D.