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Laser-Induced Carbon Nanofiber-Based Redox Cycling System

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Invited for this issue's Front Cover is the group of Nongnoot Wongkaew. The cover picture shows an example of a 3D-electrochemical redox-cycling system made from laser-induced carbon nanofiber electrodes where a fibrous insulating layer with a thickness in the range of micrometers is placed vertically between two electrodes. The cyclic voltammograms in blue and green exhibit the current response from the generator and collector, respectively, while the orange-pink one represents the situation without redox cycling. Read the full text of the Research Article at 10.1002/celc.202300271.

What aspects of this project do you find most exciting?

Laser-induced carbon nanofiber (LCNF) electrodes offer incredibly outstanding performance in comparison to traditional electrodes, especially when implemented into miniaturized electrochemical sensors, while their fabrication is very simple and material cost is extremely low (only ca. 0.20 euro per device). In addition, interdigitated electrode arrays with an inter-electrode distance of a few tens of micrometers can be obtained while they could not be fabricated on the traditional substrate, i.e., a Kapton sheet.

Does the research open other avenues that you would like to investigate?

Yes, it absolutely does. As LCNFs are breathable materials, they are highly attractive for the development of wearable sensors. We envision the integration of LCNF electrodes into face masks or bandages, for instance, which paves the way for highly sensitive detection of biomarkers in aerosol from exhaled breath and wound fluid, respectively. Furthermore, as we are able to dope the LCNFs with nanocatalysts they are really attractive to serve as non-enzymatic electrochemical sensors.

What are the main challenges in the broad area of your research?

On one hand, 3D-porous electrodes provide immense surface area where detection sensitivity can be boosted. On the other hand, such feature adversely makes the surface susceptible to non-specific adsorption of large interfering molecules like proteins especially when applied to complex matrices. In addition, reproducibility of signal generation from electrodes with different production batches, even with commercially available electrodes, is still a critical issue. This factor still restricts the translation from research into commercial products but will hopefully be overcome in the future.