

Sustainable sensors research on food, environment; Research on healthcare and wearables by Tyndall National Institute: Offerings on INFRACHIP

Alan O'Riordan¹, Brendan O'Flynn¹, Daniela Iacopino¹, Sanatana Konigulu¹, Veda Sandeep Nagaraja²

¹ Tyndall National Institute, Cork, Ireland,

² Tyndall National Institute, Cork, Ireland

Corresponding Author veda.sandeep@tyndall.ie

Summary:

Tyndall National Institute is a research institute affiliated to University College Cork. Tyndall is the Coordinator of the free technology and infrastructure access programme INFRACHIP. Amongst the various technology pillars under which the offerings are available, sensors and sustainable sensors along with system development through packaging are most sought. At Tyndall National Institute we have given access to external users on sensors technology on biophotonics for healthcare, wearable sensors, sensors for food and environmental monitoring. This paper gives a brief overview of sensors research in Tyndall and what we have on offer through INFRACHIP to external users

Keywords: Biophotonics, sustainable sensors, wearables, free access

Title

Sensors technology is rapidly growing and advancing. A lot of emphasis is also being laid out to have sustainable sensors developed. The key roadblock one faces in research is access to state of the art infrastructure. At Tyndall National Institute we have infrastructure to carry out research in biophotonics sensors, sustainable food, agriculture and environment, flexible sensors and wearables. We also have a research platform for system development. All of these are made accessible for free to external users through the INFRACHIP platform.

Sustainable sensors on Food, Agriculture and environment

Miniaturization of working electrodes as electrochemical sensors has been found to offer many advantages such as a lower detection limits, lower solution resistance and a reduction

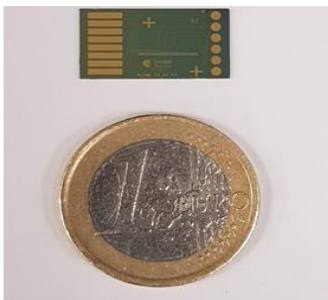


Figure 1: Fully fabricated Electrochemical chip containing 6 working IDT sensor, counter and reference electrode.

in the use of expensive materials [1]. The electrochemical sensors, developed by Tyndall, as seen in figure 1 typically contain multiple interdigitated ultra-microelectrode arrays with critical dimension of 1 μm width and 45 μm length. The other electrode comb in the interdigitated setup can be used as an in-situ pH probe by monitoring the potential at which the gold oxide reduction peak occurs when undergoing cyclic voltammetry. This ability for pH tailoring on chip can allow for an enhanced sensitivity for detecting the analyte of interest.[2]

Robotics and wearable sensors

Tyndall's Collaborative Robotics Lab is equipped with cutting-edge technology, including the UR16e robot and Quantum Mocap Metagloves, for advanced robotics and VR research. Its comprehensive capabilities make it a leader in practical and innovative robotics and VR/AR applications. Human Biomechanics is an intriguing discipline that bridges biology and physics, examining human body movement and function through mechanical physics principles. This approach helps researchers unravel the complexity of human motion and understand the roles of force, torque, and equilibrium in controlling daily activities. It is a vital area of study in sports science, medicine, ergonomics, and engineering, providing critical insights that can improve performance, prevent injuries, and enhance overall well-being. Figure 2 gives an

overview of the AR VR applications of sensors research at Tyndall.

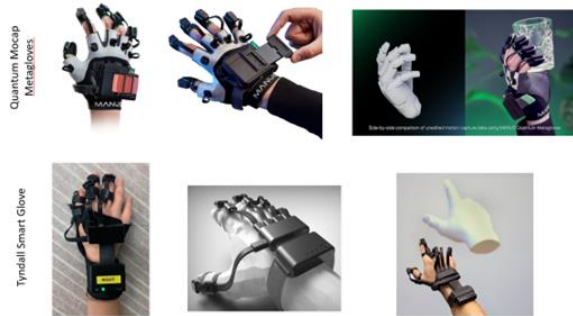


Figure 2: AR VR sensor development at Tyndall

Biophotonics Probe and sensors integration (BioProbe)

Advancements in biophotonics have opened new frontiers in medical diagnostics, environmental monitoring, and other critical fields. At the forefront of this innovation is the BioProbe initiative, a initiative focuses on the meticulous design and integration of miniature probes and sensors for prototyping, addressing the unique demands of biophotonics applications. Tyndall has experience in the design and development of miniature probes for wide range biophotonics technologies including time domain diffuse reflectance spectroscopy, fluorescence lifetime imaging, fluorescence and Raman probes. By leveraging their expertise, the team at Tyndall has developed number of demonstrators showcasing our highly specialized probes technology, that enhance performance at reduced probe footprint, driving forward the capabilities of biophotonic technology [3]. Figure 3 is an image of a Bioprobe developed at Tyndall.

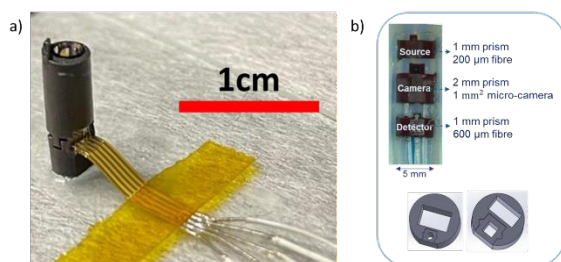


Figure 3: Bioprobe developed at Tyndall

Sensor development on flexible substrate

Tyndall has developed a research platform to develop and integrate sensors using the Direct Laser Writing (DLW) facilities. Direct Laser Writing (DLW) is a fabrication technique that uses a focused laser beam to create precise three-dimensional graphitic micro- and nanostructures on various substrates from synthetic polymers and natural bioplastics. Engraving machines with different

wavelengths, ranging from 405 nm to 450 nm and infrared (IR), are used for this process. Using this facility it is possible to fabricate the transducing components of wearable biosensing devices on flexible polymeric or bioplastic substrates. Figure 4 gives the DLW set up



Fig. 4. Direct Laser Writing set up at Tyndall

Conclusion

INFRACHIP is a free technology and infrastructure access programme open to researchers across all domains. It is open to industries, SMEs, research organisations and academic institutions. It helps a researcher or industry personnel to overcome the hurdle to access infrastructure which does not exist within their own organization. Tyndall has a large infrastructure available on sensor development in many areas and we welcome external users to make best use of INFRACHIP platform. For more queries, one can contact the corresponding author of this paper,

References

List and number all bibliographical references at the end of the paper. When referenced within the text, enclose the citation number in square brackets, i.e. [1]

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