# In Operando Nanothermometry in Electrochemical Devices by Nanodiamond Quantum Sensors

Q Li[1]

[1]*Department of Physics, The Chinese University of Hong Kong, Shatin, New Territories, Shatin, Hong Kong.*
*Contact Phone: +39436323*
Contact Email: liquan@cuhk.edu.hk

Temperature plays a crucial role in the operation of electrochemical devices, serving as both an indicator of device efficiency and stability. However, the complex material architecture within the device, coupled with local variations in electrochemical activity, leads to a time-dependent and spatially varying temperature at the nanoscale. Information on the spatially resolved temperature evolution is challenging due to the lack of non-invasive and accurate nano-thermometry methods that meet the requirements for sensitivity, spatial resolution, and temporal resolution within the reactive chemical environment of a functional device. In this presentation, I will discuss our recent progress in developing nanodiamond based thermometry to monitor the spatially resolved temperature evolution in operational electrochemical devices, including miniaturized battery cells and electrolyzers. We show that the local temperature within the working device, especially at the reaction interface, is considerably higher than the spatially averaged temperature measured from outside of the device using conventional methods. Spatial temperature variation has been found in conjunction with the respective electrochemical processes, disclosing the site sensitive chemical reactivity and its dynamics.

*Acknowledgements*: This work is carried out in collaboration with Renbao Liu, Wenghang Leung, Ruqiang Dou, Zan Li, Hui Wang, Yao Gao, Ying Wang, and Chunyi Zhi. The authors acknowledge funding support from RGC CRF C4004-23G.