Proceedings of the Canadian Society for Mechanical Engineering International Congress 2022
CSME Congress 2022
June 5-8, 2022, Edmonton, AB, Canada

NANOCOLUMNAR ELECTRODES FORMED BY GLANCING ANGLE DEPOSITION AS A HIGH-PERFORMANCE BIOSENSING PLATFORM

Ken D. Harris[1,2]
[1]National Research Council Canada, Nanotechnology Research Centre, Edmonton, Canada
[2]Department of Mechanical Engineering, University of Alberta, Edmonton, Canada
*ken.harris@nrc-cnrc.gc.ca

ABSTRACT

In the glancing angle deposition (GLAD) technique, dynamic substrate motion is employed during a thin film deposition process in order to engineer surface-bound nanoscale structures with precisely-controlled shapes. In this presentation, I will outline the GLAD technique in detail and describe the range of morphologies, materials and applications that are accessible using GLAD. I will then narrow down to focus on a particular application area by reviewing our ongoing efforts to utilize GLAD in the fabrication of high surface area electrodes for biosensing applications. The biosensors include: NiO-based electrochemical devices to quantify glucose, xanthine, and other analytes; indium tin oxide (ITO) devices for pathogen detection and classification; and colorimetric biosensors for uric acid that can be read by eye. In general, the morphology control built into the GLAD technique allows the electrode structure to be adjusted for optimized performance, and the massive surface area created by the nanocolumnar structure leads to significantly improved sensitivities and limits of detection vs. contemporary sensors. Surface functionalization techniques to attach specific molecules to the outside of the GLAD-based electrode will also be a recurring theme. In particular, the attachment of enzymes or biologically-derived receptors that bind particular analytes tends to vastly improve the specificity of the sensors.