Detection of Nitric Oxide From the Mouse Colon Using a Boron-Doped Diamond Microelectrode Modified with Platinum Nanoparticles and Nafion

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1. Introduction

Boron-doped diamond (BDD) has made a significant impact on the field of electrochemical analysis owed to its many advantageous properties including a wide working potential window, low background current, stable film morphology and microstructure, fouling resistance, and fast electron transfer kinetics for several redox systems in a variety of electrolyte media.[1-3] BDD has been proven particularly useful in neurochemical analysis, providing a reproducible and sensitive oxidative current response to norepinephrine, serotonin, and nitric oxide (NO) *in vitro*.[4-6] In this presentation, we expand on the application of BDD in neuroanalytical chemistry to report on the detection of NO release from myenteric ganglia in the mouse colon.[7]

The enteric nervous system is a division of the autonomic nervous system that controls important gastrointestinal tract activity. Intestinal motility, or the coordinated contraction and relaxation of muscles used to propel food content in the gut, is regulated primarily through the release of acetylcholine from excitatory motor neurons and NO and ATP—or a similar purine—from inhibitory motor neurons.[8-10] Disruption of these signaling mechanisms could cause GI dysfunction. The ability to measure the release and clearance of signaling molecules near their sites of action provides an invaluable tool for studying underlying mechanisms of gut motility. Electrochemical microelectrode sensors offer the spatiotemporal resolution needed for detecting these dynamic concentration changes and were used to detect NO release from mouse myenteric ganglia.

NO was measured directly as oxidation current using a Nafion coated platinized BDD microelectrode, the design of which can be seen in figure 1. Briefly, a sharpened 76 µm diam. Pt wire was overcoated with a layer of nanocrystalline diamond using microwave-assisted chemical vapor deposition. To reduce the overpotential needed to drive NO oxidation, platinum nanoparticles were electrodeposited onto the BDD substrate and the modified electrode was then dip-coated in a Nafion solution to electrostatically repel negatively charged interferents such as the nitrite anion. This presentation will focus on the Nafion/Pt/BDD sensor design and application *in vitro*.

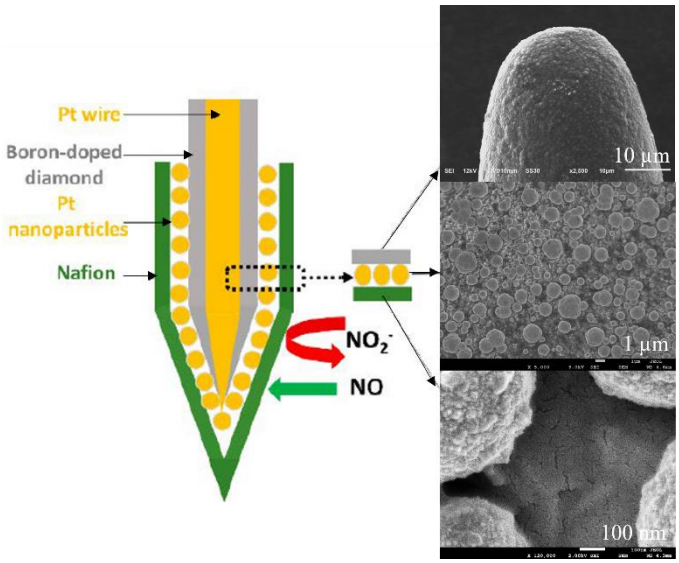

Figure 1. Schematic of the Nafion/Pt/BDD microelectrode sensor design.[7]

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