Electrocatalytic Properties of Electrodeposited Noble Metals for the Reduction of Nitric Oxide and Nitrous Oxide at and Their Detection

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Nitric oxide (NO) has been established as one of the most important cellular messenger molecules in human biology, and has been associated with many physiological processes and diseases [1]. The in vivo detection of NO has been a challenging task due to its very short half-life (~6 s), low concentration, and easy oxidation by reactive oxygen species [2]. It is therefore desirable to develop techniques that can be applied to the in vivo detection of NO in a selective, sensitive, and quantitative manner. Most measurements of NO release in biology or medicine adopt indirect methods relying on the assay of the secondary species or the metabolized and oxidized products of NO. These techniques are nevertheless not applicable to the in vivo and real time detection of NO, despite their poor selectivity and/or sensitivity. Electrochemical-based approaches, especially microsensors based on chemically modified ultramicroelectrodes, proven very promising for the in vivo and real-time detection of NO in biological media. Most of the reports on the electrochemical detection of NO used its oxidation as the measurement reaction [3]. The detection of NO by its electrocatalytic oxidation, albeit its demonstrated success and application, could be interfered by the co-existence of other oxidizable biomessenger molecules such as H$_2$O$_2$, ascorbate and catcholamines whose oxidation potentials usually appear at a more negative position with respect to that of NO oxidation. It is therefore necessary to be able to detect NO in reductive mode in certain applications.

In addition, N$_2$O, traditionally known as the laughing gas, is a nerve-stimulating molecule. It was proposed as a possible candidate as the direct product of nitric oxide (NO) synthase recently [4].

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Here, we report a very strong and electrocatalytic reduction of NO and N₂O at some noble metals (e.g. Pt, Pd and Rh) coated glassy carbon (GC) electrode surface. For example, Fig.1 shows the electrocatalytic reduction of NO (A) at Rh and N₂O (B) at Pt electrodeposited on GC electrode surface by cycling the potential in a freshly prepared modified solutions, respectively.

![Graph A](image1.png)

**Fig. 1** Electrocatalytic reduction of NO at Rh/GC electrode (A) and N₂O at Pt/GC electrode (B) in PBS.

The transition metals electrodeposited by this method display a very good electrocatalytic activity on NO or N₂O in neutral medium. Therefore, these very interesting electrocatalytic reduction reactions displayed at these electrodes can be employed as the basis for the sensitive and selective detection of NO and N₂O.


