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CeO_2-modified $LaNi_{0.6}Fe_{0.4}O_3$ perovskite and MWCNT nanocomposite for electrocatalytic oxidation and detection of urea

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Abstract

A perovskite-type oxide ($LaNi_{0.6}Fe_{0.4}O_3$-CeO_2, LNF-C) and multiwalled carbon nanotube (MWCNT) composite was employed as a novel catalyst material for the electrochemical oxidation of urea in an amperometric urea sensor. The structural and morphological properties of the LNF-C/MWCNT nanocomposite were studied by X-ray diffraction and scanning electron microscopy. The Ni-based pervoskite exhibited higher electrocatalytic activity than a single NiO compound, and CeO_2 further improved the activity and stability. The reaction of urea electrooxidation on LNF-C occurred via 6-electrons, and was a half-order reaction with respect to urea concentrations in alkaline solution, as observed by cyclic voltammetry studies. The LNF-C/MWCNT modified electrodes exhibited a sensitivity of 195.6 $\mu AmM^{-1}cm^{-2}$ in a linear range from 25 to 670 μM of urea with a low detection limit (1 μM), fast response time (5 s), and good stability. In addition, the urea sensor demonstrated feasibility for urea analysis in real urine samples. The results indicated that the LNF-C/MWCNT composite could be used as an effient catalyst for the electro-oxidation of urea and electrode material for non-enzymatic urea sensors.

Keywords: perovskite, ceria, nickel, MWCNT, electrocatlyst, urea oxidation, urea sensor

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