NOVEL ELECTRODE MATERIALS FOR THE DETERMINATION OF HIGH CONCENTRATIONS OF STRONG OXIDANTS

F. Terzi[1], B. Zanfrognini[1], J. Pelliciari[1], Laura Pigani[1], C. Zanardi[1], R. Seeber[1]
[1]Dipartimento di Scienze Chimiche e Geologiche, Università degli Studi di Modena e Reggio Emila, Via G. Campi, 183 – Modena

The determination of strong oxidizing species is of outmost importance in a number of practical applications. However, the current instrumentations and methods should be improved in terms of reliability, automatisation and costs. With this respect amperometric techniques are particularly promising; nevertheless, the performance of conventional electrode materials, such as Au and Pt, are not satisfactory, in particular in terms of resistance to fouling. In addition, eElectroanalytical methods and devices most commonly pay highest attention to the determination of analytes present in trace amount. However, the determination of high concentrations is of particular importance in industrial and environmental contexts. On the other hand, dilution often implies shift of equilibria and impossibility to operate in-line, as well as the addition of errors and malfunctions implicit in the operation.
The present contribution reports the electrochemical behavior of alternative electrode materials, namely Cu and Ti, in the presence of different oxidants, e.g. H_2O_2 and HClO, at high concentrations (up to 0.5 M) and at different pH values. The interaction of oxidants with Cu and Ti has been poorly investigated: the majority of the efforts have dealt with H_2O_2 in the frame of studies far from analytical chemistry, such as prostheses development, corrosion resistance and electronics. Literature reports only few examples of amperometric determination of oxidants employing Cu and Ti electrodes; the majority of them deal with H_2O_2 at low concentration levels (<1 mM). Furthermore, at variance with most of literature reports that focus their attention only on few buffered solutions, in this contribution the behavior of Cu and Ti electrodes in real matrices, e.g. detergents, is also reported. The results have been fruitfully employed to the development of analytical procedures for the determination of the different oxidising species. A statistical treatment of the electrochemical responses suggests that the repeatability and reproducibility are well adequate.
Finally, the electrode surface has been characterised by scanning electron microscopy, X-ray diffraction and Raman spectroscopy. In order to verify the influence of strong oxidising species on the electrode surface, these investigations have been carried out both before and after the amperometric determination of the analytes.