



Iron-phthalocyanine complexes immobilized in nanostructured metal oxide as optical sensors of NO_x and CO: NMR and photophysical studies

Angel Valero-Navarro^a, Jorge F. Fernandez-Sanchez^{*a,b}, Antonio Segura-Carretero^a, Ursula E. Spichiger-Keller^b, Alberto Fernandez-Gutierrez^{*a}, Pascual Oña^c and Ignacio Fernandez^{*c}

^a Department of Analytical Chemistry, Faculty of Sciences, University of Granada, C/Fuentenueva s/n, E-18071 Granada, Spain

^b Centre for Chemical Sensors. Swiss Federal Institute of Technology (ETH-Z), Technoparkstrasse 1, 8005 Zurich, Switzerland

^c Department of Organic Chemistry, University of Almería, Carretera de Sacramento s/n, E-04120 Almería, Spain

Received 9 September 2008

Accepted 10 October 2008

ABSTRACT: This paper presents the research that is currently undergoing in our group toward the development of optical sensing layers based on iron(II) phthalocyanine complexes immobilized on nanostructured solid supports. Several FePc-N donor ligands have been prepared and coated into different nanostructured metal oxides. Optical properties, chemical variables, analytical features, selectivity rates, response times and type of nanostructure supports have been evaluated; in some cases, interesting correlations between them have been deduced. In addition, thermostability studies have been carried out, providing access to a second generation of nanostructured metal oxides.

KEYWORDS: iron(II) phthalocyanine, N-donor ligand, nanostructure metal oxide, optical sensor, NO₂, CO.

INTRODUCTION

Over the last hundred of years industrial expansion has led to unprecedented environmental damage due to pollution. Nitrogen oxides (NO_x) and CO are amongst the most toxic gaseous pollutants. NO is oxidized in the atmosphere to NO₂, one of the major causes of outdoor air pollution which directly affects human health. Also, NO₂ concentrations rise immediately when there is a fire, and the concentrations do not depend on the type of material being burnt [1]. Therefore, NO₂ is an early indicator of the heat produced by fire and its detection would be much more efficient than when it is noticed

by other techniques used in commercially available fire alarms. False alarms can also be reduced since smoke and ammonia can be readily differentiated from NO₂, the concentration of which rapidly increases with increasing heat [1]. In addition, among other processes, CO is produced by the incomplete combustion of wood or hydrocarbon products [2]. It is in fact a byproduct in almost all combustion processes. CO causes tissue hypoxia by displacing oxygen from carboxyhemoglobin, inhibiting the transfer of oxygen in organisms. The diagnosis of CO poisoning is difficult because the initial symptoms tend to be very vague and may progress rapidly to coma and death [2]. It has been found that the concentration of CO in breath increases upon poisoning with this gas [3]. Therefore, the availability of a rapid, cheap, and non-invasive diagnostic test for abnormal CO exposure in hospital emergency departments may enable the quick detection of CO poisoning and thus prevent casualties.

*Correspondence to: Jorge F. Fernández-Sánchez, email: jffernan@ugr.es, tel: +34 958243296, fax: +34 958249510; Alberto Fernández-Gutiérrez, email: albertof@ugr.es, tel: +34 958243297, fax: +34 958249510 and Ignacio Fernandez, email: ifernan@ual.es