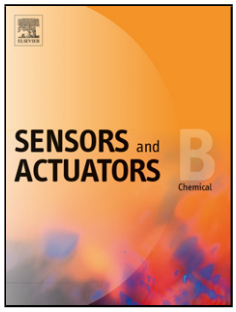

Title: Characterization of embeddable potentiometric thick-film sensors for monitoring chloride penetration in concrete

Author: José M. Gandía-Romero Román Bataller Pablo Monzón Inmaculada Campos Eduardo García Breijo Manuel Valcuende Juan Soto

PII: S0925-4005(15)30113-1
DOI: http://dx.doi.org/doi:10.1016/j.snb.2015.07.056
Reference: SNB 18787

To appear in: *Sensors and Actuators B*

Received date: 5-2-2015
Revised date: 3-7-2015
Accepted date: 13-7-2015

Please cite this article as: J.M. Gandía-Romero, R. Bataller, P. Monzón, I. Campos, E.G. Breijo, M. Valcuende, J. Soto, Characterization of embeddable potentiometric thick-film sensors for monitoring chloride penetration in concrete, *Sensors and Actuators B: Chemical* (2015), http://dx.doi.org/10.1016/j.snb.2015.07.056

Characterization of embeddable potentiometric thick-film sensors for monitoring chloride penetration in concrete

José M. Gandía-Romero[*1,2,3], Román Bataller[1,2,4], Pablo Monzón[2], Inmaculada Campos[5], Eduardo García Breijo[1,4], Manuel Valcuende[2,3], and Juan Soto[1,2,6].

[1]*Centro de Reconocimiento Molecular y Desarrollo Tecnológico (IDM), Unidad Mixta Universidad Politécnica de Valencia – Universidad de Valencia, Valencia, Spain*
[2]*Laboratorio Electroquímica Escuela Técnica Superior de Ingeniería de Edificación Politécnica de Valencia – Universidad de Valencia, Valencia, Spain*
[3] *Departamento de Construcciones Arquitectónicas. Universidad Politécnica de Valencia. Camino de Vera s/n. E-46022, Valencia, Spain.*
[4]*Departamento de Ingeniería Electrónica. Universidad Politécnica de Valencia. Camino de Vera, s/n, E-46022, Valencia, Spain.*
[5]*Queen Mary University of London. Mile End Road, London E1 4NS*
[6]*Departamento de Química. Universidad Politécnica de Valencia. Camino de Vera s/n. E-46022, Valencia, Spain*

** Corresponding author mail: joganro@csa.upv.es, Telf: 00 34 963873490*

Abstract

In order to monitor the chloride penetration processes, a potentiometric embedded thick-film sensor was developed. This paper includes the results of research on the characterization of Cl^- sensors made of Ag/AgCl resistive pastes (materials, sensitivity and detection limit, reproducibility, reversibility and response time, long-term performance and reliability in the presence of interfering agents). Theoretical expressions have been developed to describe the potentiometric response including the presence of OH^- and bromide ions. The study shows that thick-film sensors are able to monitor Cl^- activity as a function of the redox potential. Sensors are also capable of providing reliable and continuous real-time information on phenomena related to the progress of the chloride penetration front in concrete specimens. These sensors are a promising tool because thick-film technology allows us to obtain miniaturized, low-cost, robust and stable long-term sensors for Cl^- monitoring.

Keywords

Chloride ion, sensor, potentiometric, corrosion, thick-film, concrete.

1. Introduction

As it is well known, in reinforced concrete structures the most critical area is the rebar cover. The concrete cover of the rebar acts as a barrier to the access of chlorides and CO_2, avoiding their attack on the steel bars. Nevertheless, over time these aggressive agents gain access through the cover and cause deterioration.

The monitoring and control of the parameters affecting corrosion processes allows future problems to be detected in advance and to plan possible corrective actions to ensure that the structures reach the service requirements for which they were designed. Real-time monitoring of the cover parameters that can affect the stability of the reinforcing bar through non-destructive and non-invasive techniques is therefore necessary to ensure the durability of the structure. In this sense, monitoring systems derived from sensors embedded in the reinforced structures become a very useful technique for the supervision of parameters related to the durability of the structures in a direct or indirect way.