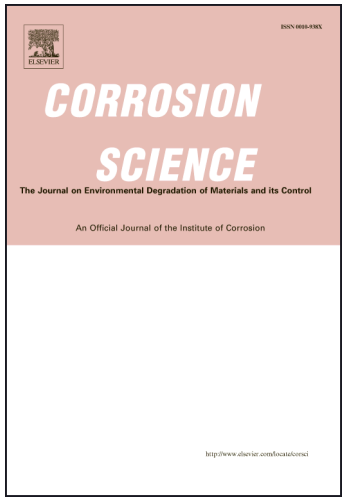

Mechanistic studies of corrosion product flaking on copper and copper-based alloys in marine environments

Xian Zhang, Inger Odnevall Wallinder, Christofer Leygraf

PII: S0010-938X(14)00151-6
DOI: http://dx.doi.org/10.1016/j.corsci.2014.03.028
Reference: CS 5785

To appear in: *Corrosion Science*

Received Date: 6 December 2013
Accepted Date: 18 March 2014

Please cite this article as: X. Zhang, I.O. Wallinder, C. Leygraf, Mechanistic studies of corrosion product flaking on copper and copper-based alloys in marine environments, *Corrosion Science* (2014), doi: http://dx.doi.org/10.1016/j.corsci.2014.03.028

Mechanistic studies of corrosion product flaking on copper and copper-based alloys in marine environments

Xian Zhang, Inger Odnevall Wallinder and Christofer Leygraf✉

KTH Royal Institute of Technology, Div. Surface and Corrosion Science, School of Chemical Science and Engineering,

Dr. Kristinas v. 51, SE-100 44 Stockholm, Sweden

✉ Corresponding author: chrisl@kth.se , phone: +46 8 790 6468, fax: +46 8 208284

Abstract

The mechanism of corrosion product flaking on bare copper sheet and three copper-based alloys in chloride rich environments has been explored through field and laboratory exposures. The tendency for flaking is much more pronounced on Cu and Cu-4wt%Sn than on Cu-15wt%Zn and Cu-5wt%Al-5wt%Zn. This difference is explained by the initial formation of zinc and zinc-aluminum hydroxycarbonates on Cu15Zn and Cu5Al5Zn, which delays the formation of CuCl, a precursor of $Cu_2(OH)_3Cl$. As a result, the observed volume expansion during transformation of CuCl to $Cu_2(OH)_3Cl$, and concomitant corrosion product flaking, is less severe on Cu15Zn and Cu5Al5Zn than on Cu and Cu4Sn.

Keywords

A. Alloy; A. Copper; B. IR spectroscopy; B. Raman spectroscopy; B. SEM; C. Atmospheric corrosion

1. Introduction

Copper and copper-based alloys form a large group of important construction materials for outdoor applications due to their appealing visual appearance, desirable mechanical and physical properties as well as their inherent resistance to atmospheric corrosion. Significant knowledge exists in the scientific literature on patina formation on copper in marine exposure conditions, and to some extent also for some copper-based alloys in chloride rich environments [1-7]. In sheltered marine exposure conditions cuprite (Cu_2O) is the initial phase in the evolution of the copper patina. Interaction with chlorides results in the formation of nantokite (CuCl) which commonly transforms to atacamite or the isomorphous phase paratacamite ($Cu_2(OH)_3Cl$) as the