Valuation of mill scale as iron pigments for painting anticorrosive
Belgacem BEZZINA*,a,b, Mohamed Tayeb ABEDGHARSA, Hocine BENDJAMAa, Salah BOUHOUCHEa

*a Research Centre in Industrial Technology (CRTI), P.O. BOX 64, Cheraga 16014, Algiers, Algeria
bLaboratory of Computational Chemistry and nanostructures LCCN, University May 8, 1945 Guelma, Algeria.

Abstract

The mill scale is a steelmaking byproduct. This work focuses on the valuation of the steel waste and its transformation to a usable product in the field of anti-corrosion paints. These iron oxides have been examined as a pigment and corrosion inhibitor in two types of paints with different concentrations (1 %, 3 %, 7 %, and 15 %) to determine the best formulation. Their properties were compared to that of an anticorrosion paint trademark based on iron oxide. For this purpose various techniques of mechanical and physical-chemical analysis were used; grinding is applied to pieces of mill scale for very fine powders (< 32 µm); the particle size of the milled scale analysis, to determine their particle size distribution; a primary electrochemical method used to evaluate the performance and scale vis-à-vis the phenomenon of corrosion behavior, and a UV-Visible spectroscopic method for determining the concentration of total dissolved iron. The experimental results showed that the anti-corrosion properties or rather inhibition efficiency increases with increasing concentration of the mill scale in the tested paints.

Keywords: mill scale, corrosion inhibitor, spectroscopic, electrochemical analysis.

1. Introduction

The mill scale, a byproduct of steelmaking process, is produced by superficial oxidation of the slabs and billets of steel during the cooling in continuous casting and during the reheating process and hot forming [1]. The treatment of the scale for utilization basically depends on local conditions and on the main technological approach of each region or country [2]. Generally, these co-products have been the object of a considerable number of research works for the different areas: decontamination [3-6], concrete and mortar [7, 8], pigments [1, 2] and renewable energy [9].

The pigments derived from iron oxide are increasingly important due to their chemical stability, non-toxicity, durability, low cost and wide variety of colors: black, yellow, brown and red [10, 11]. It is estimated that about 85 % of metal structures, exposed to different aggressive environments, are painted [12]. For this reason the paints based on metal pigments are used as corrosion protection.

The pigments are used in all areas of daily lives: plastic, glass, paper, paint and coating [11-13].

The purpose of this work is twofold: