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PHYSICOCHEMICAL PROBLEMS
OF MATERIALS PROTECTION

Adsorption and Corrosion Inhibiting Behavior of a New S-Triazine Derivative[1]

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Abstarct — The inhibiting effect of 4, 6-bis (5-mercapto-1, 3, 4-thiadiazol-amine) 2-phenylamino-1,3,5-triazine BMTDT on the corrosion of mild steel in acidic media has been investigated by weight loss and electrochemical methods. Results obtained reveal that this organic compound is a very good inhibitor. BMTDT is able to reduce the corrosion of steel more effectively in 1M HCl than in 1M H_2SO_4. The effect of polarization studies show that the adsorption of BMTDT follows physical adsorption in both acids without changing the mechanism of the hydrogen evolution reaction. Surface analyses were also carried out to establish the mechanism of corrosion inhibition of mild steel in acidic media. The adsorption of this inhibitor on the mild steel surface in obeys the Langmuir absorption isotherm in 1M HCl and Frumkin adsorption isotherm in 1M H_2SO_4. The corrosion behavior of mild steel with addition of different concentration of BMTDT was studied in the temperature range 308–333 K. The associated activation parameters and adsorption free energies have been determined and discussed.

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1. INTRODUCTION

Steel is the most important engineering and construction material in the world. It is used in every aspect of our lives, from automotive manufacture to construction products, from steel toe caps for protective footwear to refrigerator and washing machines and from cargo ships to the finest scalpel for hospital surgery. There are several thousand steel grades published, registered, or standardized worldwide, all of which have different chemical compositions, and special numbering systems have been developed in several countries to classify the huge number of alloys.

Corrosion problems have received a considerable amount of attention because of their attack on materials. The use of inhibitors is one of the most practical methods for protection against corrosion. Several works have studied the influence of organic compounds containing nitrogen on the corrosion of steel in acidic media [2–10]. Most organic inhibitors act by adsorption on the metal surface [5]. Organic compounds containing polar groups including nitrogen, sulfur and oxygen [11–20], and heterocyclic compounds with polar functional groups and conjugated double bonds [21–25] have been reported to inhibit corrosion. Thermodynamic model is an important tool to study the mechanism of inhibition on the corrosion of metal [26–27]. It has been known that efficient inhibitors should possess plentiful p-electrons and unshared electron pairs on either nitrogen atoms or sulfur atoms of the inhibitors and by means of transference of electrons, chemical adsorption may occur on the steel surface. Thus, the steel corrosion may be suppressed by the protective film on the steel surface. The corrosion inhibition of mild steel by BMTDT in acidic solutions has been studied using weight loss measurements, electrochemical impedance spectroscopy and potentiodynamic polarization curves. The steel surface was also examined by scanning electron microscopy (SEM) and XRD. FT-IR and UV-Visible spectroscopy were used to identify if there occurs adsorption and to provide new bonding information about the adsorption process.

2. EXPERIMENTAL DETAILS

2.1. Preparation of BMTDT

The method used to prepare BMTDT was adopted from the procedure described by [1]. The structure of BMTDT is as shown in Fig. 1.

[1] The article is published in the original.