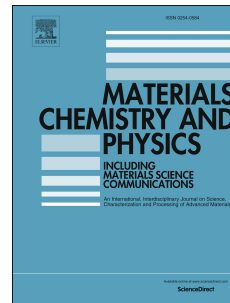


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Probing the corrosion mechanism of zinc under direct current electric field

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**Probing the corrosion mechanism of zinc under direct current electric field**Xin Zhang<sup>a</sup>, Junxi Zhang<sup>a,\*</sup>, Nianwei Dai<sup>a,b</sup>, Yan Yang<sup>a</sup>Xujie Yuan<sup>c</sup>, Fahe Cao<sup>d</sup>, Jianqing Zhang<sup>d</sup>

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**Abstract:** The influence mechanism of a direct current (DC) electric field on the corrosion behaviour of zinc in a simulated industrial environment was studied by using weight loss measurement, electrochemical tests, XRD and SEM/EDS techniques. The results show that the corrosion rate of zinc increased with the increase of DC electric field intensities. The main corrosion products formed on the sample in ZnSO<sub>4</sub> solution are Zn(OH)<sub>2</sub>, ZnO, Zn<sub>5</sub>(OH)<sub>6</sub>(CO<sub>3</sub>)<sub>2</sub> and Zn<sub>4</sub>SO<sub>4</sub>(OH)<sub>6</sub>·5H<sub>2</sub>O. It was found that the DC electric field enables OH<sup>-</sup> and SO<sub>4</sub><sup>2-</sup> ions to migrate from the solution/electrode interface to the upper layer of the solution quickly. Thus it can change the reaction site of the formation of Zn<sub>4</sub>SO<sub>4</sub>(OH)<sub>6</sub>·5H<sub>2</sub>O and can increase the quantity of the porous hexagonal plate Zn<sub>4</sub>SO<sub>4</sub>(OH)<sub>6</sub>·5H<sub>2</sub>O. All these features can promote the corrosion rate of zinc.

**Keywords:** Atmospheric corrosion; Zinc; Corrosion products; DC electric field; ions migration

## 1. Introduction

It is largely recognised that zinc is a vital metal which is widely used in corrosion protection and energy materials. Its most common use is in the application of zinc coating to carbon steel as a result of its favorable corrosion properties and relatively low price [1, 2]. Much research on the

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