Data Article

Data on the influence of ECA implant on microhardness and wear characteristics of composite coating on mild steel

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Abstract

In this study, the effect of the incorporation of composite and eco-friendly particles to develop new engineering materials on the developed zinc electrolyte containing TiO₂/TiB and Solanum tuberosum is presented. The electrodepositions were completed at 20 min at a stirring rate of 150 rpm at temperature of 50°C and pH of 4. The effect of S. tuberosum (ST) as bath additive at varied interval of 5–25 ml to the coating properties was noted. Electro-deposition parameters were constant at a voltage of 3.5 V for Zn-based coatings. The outline of bath condition as it influences the microhardness and wear rate were set into consideration. Hence, the coating microhardness and wear rate at constant electrodeposition parameters and varied ST were acquired. Hence, liquid fluid additives can be used for performance of fabricated coatings in advanced surface engineering application.

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The electrodeposition was performed using a constructed electrodeposition cell containing two zinc anodes and prepared zinc reach sulphate bath and prepared ST fluid. Mild steel was also prepared via metallography route and co-deposition with zinc based solution at varied ST concentrate. The coating Microhardness and wear rate were measured using Vickers hardness tester machine and MTR-300 abrasive tester respectively.

Before electrodeposition, pH was obtained and thermometer was used to confirm the plating temperature. The distance between the anodes and the depth of the samples were measured appropriately before co-depositing the samples.

The electro-depositions of mild steel samples were performed at 20 min at the stirring rate of 150 rpm and temperatures of 50 °C. The effect of coating mechanical properties (Microhardness and wear) were measured at constant voltage of 3.5 V for Zn-TiO2/TiB2. It was considered that the outline of bath influences in the presence of ST was put into consideration.

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Data are available within this article

1. Data

The microhardness and wear rate of the fabricated coatings at constant process parameters were collected and the experimental outline of the work data was generated and represented via plots. Electrodeposition took place at 50 °C temperature for 20 min at a stirring speed of 150 rpm. Table 1

Table 1
Chemical Composition of low carbon steel sample used.

| Element | C  | Mn | Si  | P   | S    | Al   | Ni   | Fe   |
|---------|----|----|-----|-----|------|------|------|------|
| Wt %    | 0.18| 0.45| 0.18| 0.01| 0.031| 0.005| 0.008| 99.19|
shows the chemical composition of the low carbon steel used. The influence of the incorporation of TiO₂/TiB₂/ST on wear and microhardness data was collected. Fig. 1 shows the microhardness distribution of the electrodeposited Zn–TiO₂, Zn–TiB₂ and Zn–TiO₂–TiB₂ with variation addition of Solanum (5 and 10 L) at constant current density. From the collected data, it was observed that the addition of ST on Zn–TiB₂ and Zn–TiO₂ and Zn–TiO₂–TiB₂ composited shows improved microhardness properties. Maximum hardness value of 199.6 HV₀.₁ was obtained at Zn–TiO₂–TiB₂–10ST. These highest microhardness properties hence can be linked to the network of natural eco-friendly additives participating at the formation of the coatings [1]. The wear study of Zn–TiO₂, Zn–TiB₂ and Zn–TiO₂–TiB₂ results were collected with much focus on the addition of Solanum additive on the composites coatings. Fig. 2 shows the summarized progression of the mass loss of both coated and control samples. From the collected data, it may be noted that there is considerably reduction in wear plastic deformation of the electrodeposited samples with or without the addition of ST as compared with the control samples. The generated data also shows that the addition of Solanum tuberosum gives better enhancement in anti-wear properties which is supported by result observed from [2].
2. Experimental design, materials and methods

A plane low carbon steel sheet of 60 mm × 60 mm dimension, with the thickness of 1 mm, was used as a substrate in this research. Other used materials include a zinc plate anode (99.9% pure) and grinding paper in the order of 60 μm, 120 μm, 400 μm, 800 μm, and 1,600 μm for surface preparation. An electrodeposition bath solution was prepared using distilled water. Samples were activated by sinking them into a 2 M HCl solution for 10 s, and then rinsing them in distilled water, which is in accordance with Popoola et al. [3]. The electrolyte bath were prepared a day before depositing. Stir took place continuously at the rate of 150 rpm for homogeneity. The bath ad-mixed powders used are represented in Tables 2 and 3. The choice of the deposition parameter is in line with the ones provided in the literature [4,5,7]. S. tuberosum tuber of equivalent weight of 15 g were selected, peeled, washed, and sectioned into smaller pieces. Then the smaller pieces were squeezed into deionized water to remove the fluid. The mined juice was stored in clean bottles and refrigerated. The S. tuberosum tuber used was shopped from Pretoria, South Africa [6].

Acknowledgement

The authors acknowledge Surface Engineering Research Centre, (SERC) Tshwane University of Technology, Technology Innovation Agency, Pretoria, South Africa and research financial support received from Covenant University.
Transparency document. Supporting information

Transparency data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.11.060.

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