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Effects of SIMA (Strain Induced Melt Activation) on microstructure and electrochemical behavior of Al-Zn-In sacrificial anodes

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2	Effects of SIMA (Strain Induced Melt Activation) on Microstructure and Electrochemical
3	Behavior of Al-Zn-In Sacrificial Anodes
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10	Abstract
11	The Strain Induced Melt Activation (SIMA) process is one of the semi-solid forming processes for
12	preparation of non-dendritic microstructures. In current work, the effects of SIMA process on
13	microstructure and electrochemical behavior of Al-Zn-In sacrificial anode were studied. The effect of
14	plastic deformation on the semi-solid microstructure of Al-Zn-In alloy is investigated by applying 10-
15	40% uniaxial compression at ambient temperature and semi-solid treatment was carried out in the
16	range of 635 to 660°C for 40 min. Investigation of the electrochemical behavior of anode and Tafel
17	polarization test are performed in 3.5 wt.% sodium chloride solution. The results indicate that
18	microstructure of the SIMA processed specimens is finer and more spherical than that of the as-
19	received material. The sphericity increases significantly with the increase of the compression ratio
20	from 10 to 30%, but the variation rate of the average grain size increases and the shape factor
21	decreases with more increase of the compression ratio up to 40%. The average size and sphericity of
22	$\alpha$ -Al solid grains increase with the increase of the heat treatment temperature. Electrochemical tests
23	results show that plastic deformation up to 30% following heat treatment at 650°C increases the anode
24	efficiency. Furthermore, SEM results indicated uniform corrosion under the aforementioned condition.
25	
26	Keywords: Sacrificial Anode, Al-Zn-In, SIMA, Non-Dendritic, Corrosion Rate.
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## 28 **1. Introduction**

29 In recent decades, several protection systems have been used to overcome the corrosion problems 30 and its related costs. One of the most important and extensive efforts is done on the cathodic 31 protection system. Sacrificial anode system is one of the most successful methods in cathodic 32 protection systems especially in marine structures or structures known as offshore structures [1]. 33 Several anodes used in cathodic protection of offshore structures are developed day to day which are 34 often based on aluminum. Al-Zn-In anode with a high current capacity of 2400 Ah/kg is one of the

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