Electronic Supplementary Information

Influence of macroscopic defects on the corrosion behavior of U-0.79wt.%Ti alloy in sodium chloride solution

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1. The relationship between pH and potential

The potentials in 0.01 M NaCl solutions with different pH adjusted by HCl or NaOH were detected. The measured potential is of good linear relationship to pH value from about 3 to 12 shown in the figure below. The fitting equation agrees with Equation (1) well.

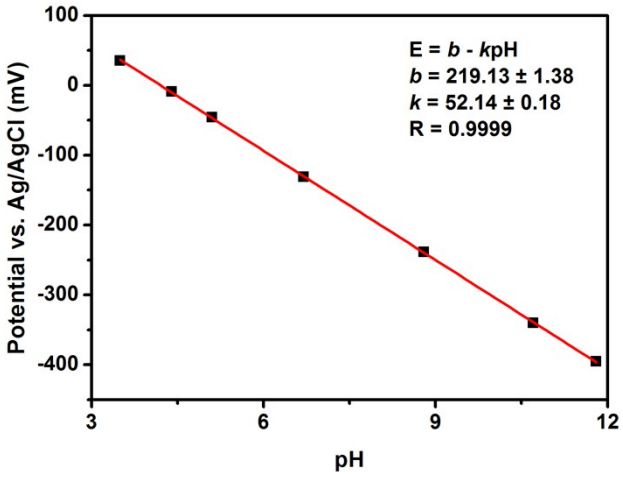

Figure S1. The relationship between pH and potential

2. EIS of the two U-0.79%Ti alloy samples with different surface state

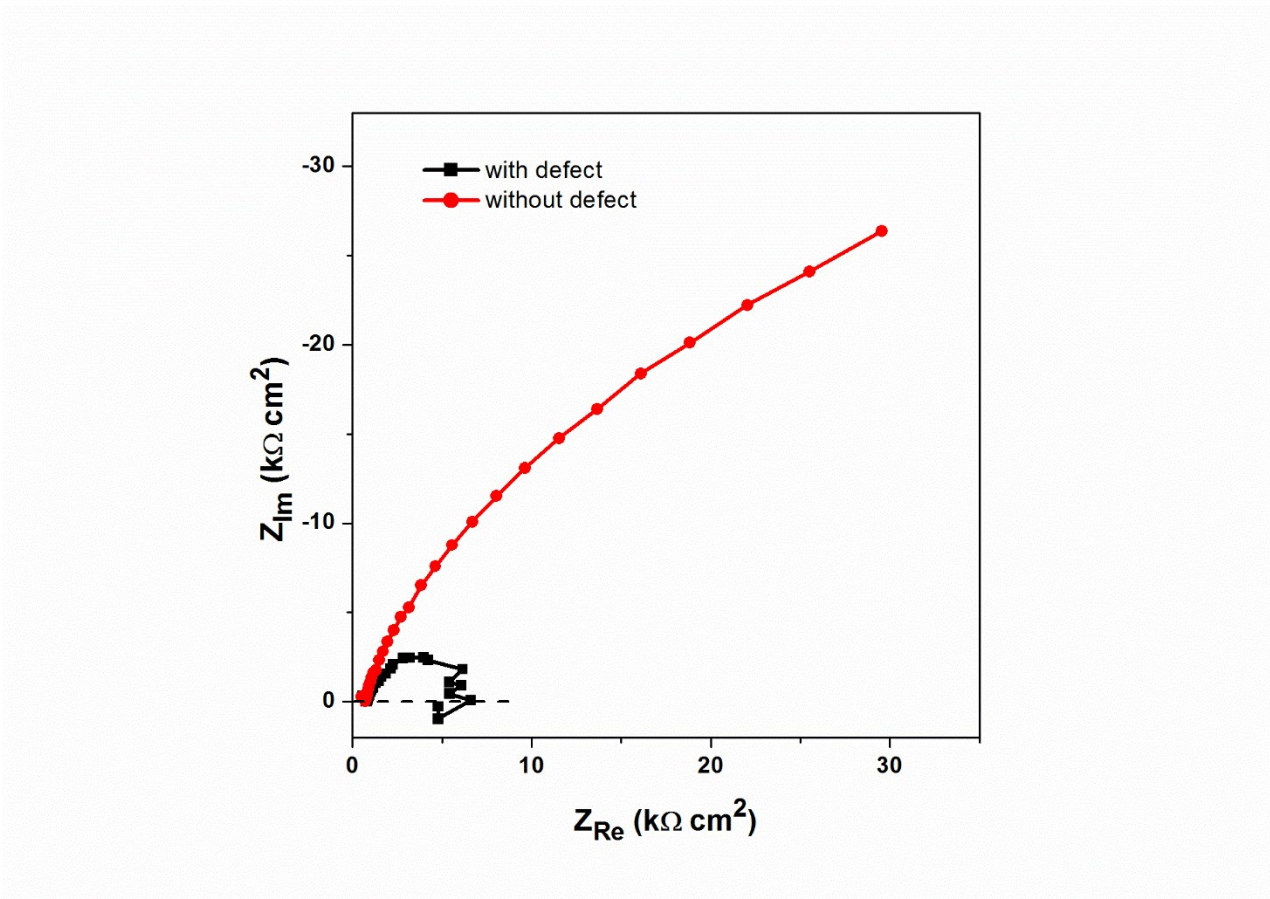

Figure S2. EIS of the two U-0.79%Ti alloy samples with different surface state: full version of Nyquist plots

3. Tafel plots of the two U-0.79%Ti alloy samples with different surface state

In Fig. S3a, the plots of the U-0.79%Ti alloy with macroscopic defect show a typical Tafel linear region in the strong polarization region during the anode process (> E_{corr} + 50 mV), while in the strong polarization region during the cathode process (< E_{corr} - 50 mV), the plots deviate from linear region significantly due to the concentration polarization. Thus, the i_{corr} of the U-0.79%Ti alloy with macroscopic defect is calculated by the intersection of the E_{corr} and the reverse extension line of the anodic Tafel plots [S1].

In the terms of the Tafel plots of the sample without macroscopic defect, the situation differs (Fig. S3b). As the there is an integrated and protective oxide membrane on the surface of the alloy, the anode process is determined by both the dissolution of the oxide membrane and the diffusion of uranium ions. While the cathode process is a fast procedure, thus in the strong polarization region during the cathode process (< E_{corr} - 50 mV), the plots show a typical Tafel linear region. Therefore, the i_{corr} of the U-0.79%Ti alloy without macroscopic defect is calculated by the intersection of the E_{corr} and the reverse extension line of the cathodic Tafel plots [S1].

The polarization resistance, R_p, is calculated by the attached software of the instrument, CorShow (V1.0.2), via linear fitting of the Tafel plots in the weak polarization region (E_{corr} ± 20 mV).

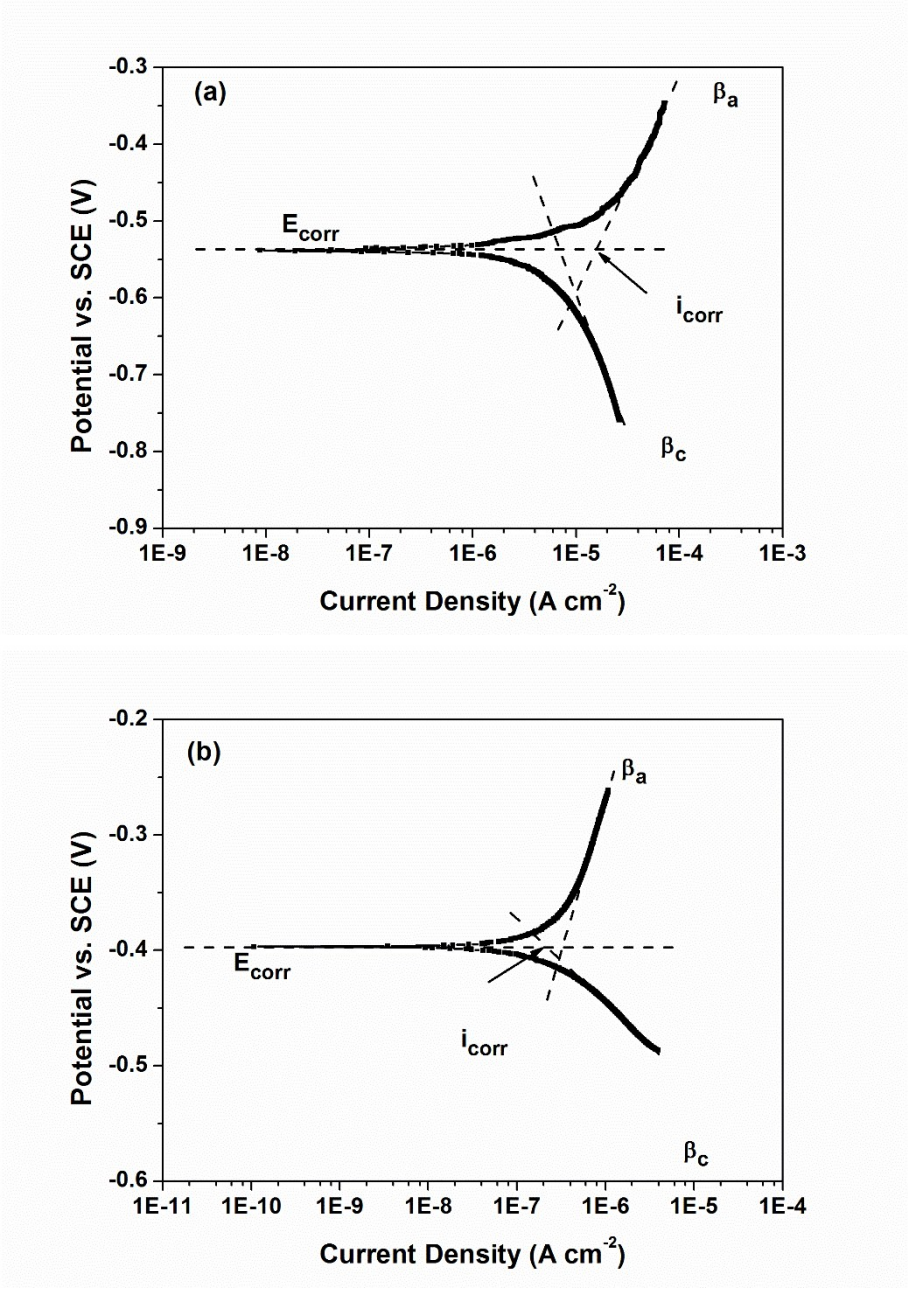

Figure S3. Tafel plots of the two U-0.79%Ti alloy samples with different surface states: a) with defect, b) without defect

Reference

[S1] S. Shetty, J. Nayak, A. N. Shetty. Influence of sulfate ion concentration and pH on the corrosion of Mg-Al-Zn-Mn (GA9) magnesium alloy, Journal of Magnesium and Alloys 3 (2015) 258–270