The Cathodic Reduction of Zn (II) on the Zn and Au Electrode in the Zinc(II)–NH₄Cl System

Qingfeng Shen¹, Shuangquan Xu¹, Wenzhi Zhang¹, Xiaohua Yu^{1,*}, Chunxia Liu^{2,*}

¹ Faculty of Metallurgical and Energy Engineering, Kunming University of Science and Technology, Kunming, 650093, PR China;

² Analyses and Test Research Center, Kunming University of Science and Technology, Kunming, 650093, PR China;

*E-mail: yxhyxh1978@ailun.com, cxliu1976@sina.com

Received: 8 September 2020 / Accepted: 18 January 2021 / Published: 10 August 2021

In recent years, the leaching of complex minerals containing zinc using the ammonia method has attracted much attention, but there are few basic studies of the cathodic reduction in the zinc(II)–NH₄Cl system. In this paper, the differences of Zn (II) reduction on the gold electrode and the zinc electrode were compared using cyclic voltammetry (CV), and the factors of influencing Zn(II) reduction on the zinc electrode were investigated by using a steady-state polarization curve method. The influence of temperature and the potential scope on the hydrogen evolution reaction was investigated using linear potential sweep and chronocoulometry on the zinc electrode. The results show that the discharge velocity of Zn (II) on the zinc electrode was faster than on the gold electrode, and the change from steady-state to transient Zn (II) on the zinc electrode was easily affected by the scanning rate. This is an effective method of increasing the temperature, intensity of stirring and Zn (II) concentration to Zn (II) reduction due to the depolarization effect. The form of Zn (II) was related to the NH₄⁺ concentration in the solution. Increasing NH₄⁺ concentration played a polarization role on Zn (II) deposition. The electron transfer coefficient of the hydrogen-evolution reaction was in direct proportion to temperature in the electrodeposition process, and the hydrogen evolution reaction was aggravated with an increase in the cathode overpotential.

Keywords: Zinc(II)–NH₄Cl system; Zinc electrodeposition; cathodic reduction; Substrate

[FULL TEXT](#)

© 2021 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).