Electrochemical Characteristics of Intermetallic Phases and Associated Micro/nano-Galvanic Corrosion in Biodegradable Zn alloys

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Abstract To minimize the harm of secondary surgeries to the human body, biodegradable alloys have become a research focus. Among them, biodegradable Zn alloys have been widely studied in clinical applications, especially in areas such as bone screws, bone plates, and cardiovascular stents, due to their suitable degradation rate. However, there is currently a lack of systematic research on the galvanic corrosion of biodegradable Zn alloys. A comprehensive analysis of the electrochemical properties of common intermetallic compounds (IMCs) in biodegradable Zn alloys was provided in this study. Utilizing micro-scale electrochemical testing methods, the influence of environmental variables such as [Cl-] and pH on the corrosion potential, pitting potential, repassivation potential, corrosion rate, and current of IMCs was comprehensively evaluated. The microgalvanic corrosion mechanism between the biodegradable Zn alloy matrix and IMCs was revealed, which is of significant importance for adjusting the corrosion rate of Zn alloys and avoiding localized corrosion damage.

Keywords Zn alloys, galvanic corrosion, intermetallics, electrochemistry