

## Corrosion behavior and mechanical integrity of Zn-based guided bone generation (GBR) membrane subjected to U-bending deformation

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**Abstract** Zinc (Zn) and its alloys have recently emerged as promising candidates for guided bone regeneration (GBR) membranes, due to their favorable mechanical properties, controlled degradation rates, effective osteogenic performance in vivo, and broad-spectrum antibacterial activity. The membrane frequently requires intraoperative bending or shaping to accommodate diverse bone abnormalities, creating stress concentration at the distortion areas. The membrane should also avoid abrupt collapse induced by the pressure of the underlying soft tissue during the chewing function. However, the impact of strain and stress on the corrosion behavior of zinc and its alloys remains relatively unexplored. In this study, pure Zn strips or membranes with different pore sizes (300  $\mu\text{m}$ , 600  $\mu\text{m}$  and 1000  $\mu\text{m}$ ) were fabricated, and the effect of pre-strain on the degradation of these materials were systematically studied by U-bending treatment, followed by immersion and mechanical tests. The pre-strain accelerated the corrosion rates of both pure Zn strips or membranes with an elevated ratio of 78.02 % (strips), 27.33 % (300  $\mu\text{m}$ ), 32.09 %  $\mu\text{m}/\text{yr}$  (600  $\mu\text{m}$ ) and 52.77 %  $\mu\text{m}/\text{yr}$  (1000  $\mu\text{m}$ ). Besides, the finite element simulation results indicated that stress concentration occurred at the maximum deflection sites, leading to the rupture of surface protective layer and formation of micro cracks. The applied strain would accelerate the mechanical integrity decay of pure Zn membranes.

**Keywords** Biodegradable zinc; Guided bone regeneration (GBR) membranes; U-bending deformation; Corrosion behavior; Mechanical integrity

### Reference

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