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Surface Integrity and Corrosion Performance of Biomedical Magnesium-Calcium Alloy Processed by Hybrid Dry Cutting-Finish Burnishing

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Abstract

Biodegradable magnesium-calcium (MgCa) alloy is a very attractive orthopedic biomaterial compared to permanent metallic alloys. However, the critical issue is that MgCa alloy corrodes too fast in the human organism. Compared to dry cutting, the synergistic dry cutting-finish burnishing can significantly improve corrosion performance of MgCa0.8 (wt %) alloy by producing a superior surface integrity including good surface finish, high compressive hook-shaped residual stress profile, extended strain hardening in subsurface, and little change of grain size. A FEA model was developed to understand the plastic deformation of MgCa materials during burnishing process. The measured polarization curves, surface micrographs, and element distributions of the corroded surfaces by burnishing show an increasing and uniform corrosion resistance to simulated body fluid.

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