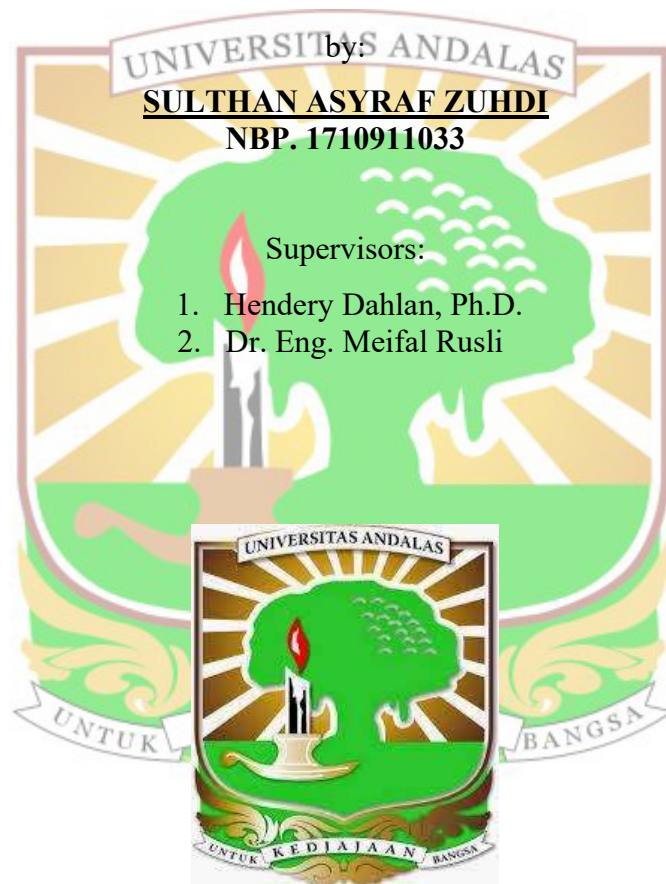


UNDERGRADUATE THESIS

Analysis of Mechanical Properties of Biodegradable Implants Material: Pure Zinc and Stainless Steel 316L for Bone External Fixation

*Submitted to Department of Mechanical Engineering, Faculty of Engineering,
Andalas University for the requirement to accomplish the degree of Bachelor*



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ABSTRACT

Metallic biomaterials, such as titanium, cobalt-chromium alloys, and stainless steel, are being manufactured into pins and screws. Pins or screws are typically taken out after the bone fracture has healed and fused since they cannot decompose naturally. A second surgery is required to remove it, which invariably leaves holes in the bone that could lead to refracture. Meanwhile, the release of toxic metal ions and particles during corrosion and abrasion processes has restricted the use of metallic biomaterials. Previous studies have been done on biodegradable metals such pure iron (Fe) and magnesium (Mg) alloys. These two biodegradable metals have a problem in their degradation control. Pure zinc (Zn) has a degradable rate of 0.55 mm/year, which is the desired degradable rate. A new solution in the form of partially biodegradable bone pins or screws can be developed by examining this gap. This study obtained several welding parameters that can be used in friction welding between pure zinc (Zn) and stainless steel 316L, including the optimal friction time of 35 s, the optimal friction pressure of ~3.0 MPa, and the optimal forging pressure of ~4.5 MPa with a friction welding machine rotation speed of 1445 rpm. The average tensile strength and bending strength of the specimens with optimal time variation (35 s) are still quite low (53.927 MPa and 9.865 MPa) when compared with the tensile and bending strengths of the base materials such as pure zinc (160.300 MPa and 42.030) and stainless steel 316L (806.793 MPa and 279.735 MPa). This study showed that the friction welding between pure zinc (Zn) and stainless steel 316L was done perfectly, but there was no intermetallic bond at the welded joint.

Keywords: biodegradable metals, friction welding, bone pin, pure zinc, stainless steel