Using Grain Refinement to Improve the Corrosion Resistance and Mechanical Properties of A205-T7 Aluminum Alloy

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Composed of a unique combination of aluminum, copper, titanium, and other trace elements, A205-T7 is the strongest cast aluminum alloy in existence. A205-T7 is lightweight, heat-resistant, and easy to cast, creating a plethora of applications for A205-T7 in commercial and military industries. However, A205-T7 can corrode over time, which severely deteriorates the quality and life of the otherwise excellent alloy. No research has explored improving the corrosion resistance of A205-T7 to ameliorate its industrial viability. The purpose of this research was to explore using microstructural refinement to improve the corrosion resistance of A205-T7. Samples were cast in molds with different heights, allowing for different cooling rates. The resultant variability in the grain size, or size of each microstructural crystal, was then studied for its effects on the properties of A205-T7. It was found that samples with small grains, or more refined microstructures, displayed superior hydrophobicity. This repulsion of water decreased the surface area in which water would come in contact with the alloy, diminishing the medium for a corrosion reaction. Thus, grain refined samples displayed improved corrosion resistance. Furthermore, hardness measurements were done to ensure grain refinement does not impede the natural strength of this alloy. Instead, it was found that grain refinement improved the hardness of A205-T7. As the first research on improving the corrosion resistance of A205-T7 to expedite and amplify its industrial applicability, grain refinement shows promise as a novel, effective, and ineffective means of improving both the corrosion resistance and mechanical properties of A205-T7 aluminum alloy.

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