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CORROSION AND MECHANICAL BEHAVIOR OF AN Al-3WT% MG ALLOY SOLIDIFIED UNDER UNSTEADY-STATE SOLIDIFICATION CONDITIONS

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Aluminum alloys with Mg addition comprise an important class of alloys used in the automotive and aeronautical industries and in marine components. Despite their importance also in the as-solidified condition, studies on the microstructural development of such alloys are scarce in the literature. The mechanical properties and corrosion resistance of metallic alloys depend strongly on the solidification microstructural arrangement. In this sense, optimizing solidification conditions may be fundamental for the achievement of desired application properties. In the present study, the directional solidification (DS) of an Al-3wt%Mg alloy under unsteady-state solidification conditions is investigated in an attempt to characterize the evolution of microstructural features along the length of the DS casting and to correlate them, via experimental growth laws, with mechanical and corrosion resistances. The cooling rates in the range from 25K/s to 0.5 K/s have been associated with the microstructure morphology, typified by a dendritic pattern along the entire casting length. A straight correlation of mechanical properties (tensile strength and elongation) and dendritic spacing has been observed, with both properties decreasing with the increase in the primary arm spacing. The best corrosion behavior of the analyzed samples is shown to be associated with coarser dendritic arrays.