Thermodynamic Properties and Phase Stability of UNS#A97075 Alloy: Insights for Advanced Engineering Applications

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Abstract

The UNS#A97075 alloy, a high-performance aluminum-zinc alloy, has garnered significant attention for its exceptional mechanical and thermal properties, making it a critical material in aerospace, automotive, and marine applications. This study delves into the thermodynamic properties of UNS#A97075 to provide a comprehensive understanding of its behavior under varying thermal and environmental conditions.

The research investigates the alloy's heat capacity, thermal conductivity, enthalpy, and entropy changes, utilizing experimental measurements and computational modeling to validate the findings. The phase stability of UNS#A97075 is explored across a broad temperature range, with a focus on phase transformations, solvus temperatures, and the precipitation kinetics of strengthening phases. The thermodynamic analysis further examines the effects of alloying elements and impurities on the material's thermal performance and stability.

Results highlight the alloy's superior thermal conductivity and heat resistance, alongside its capacity to maintain structural integrity under thermal cycling conditions. These properties are attributed to its optimized microstructure and controlled precipitation of intermetallic phases. The findings provide valuable insights into the alloy's performance, supporting its application in high-temperature and high-stress environments.

This study contributes to the growing body of knowledge on high-performance alloys, offering a framework for the design and optimization of advanced materials tailored for demanding engineering applications. Future research directions are outlined to further enhance the understanding and application of UNS#A97075 in emerging technologies.

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