

Investigating Material Degradation and Durability in Hypersonic Environments

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Hypersonic flights present formidable challenges in material science, particularly concerning wing tip materials. This review paper delves into material degradation mechanisms and factors influencing durability in hypersonic environments. We explored high-temperature properties, oxidation, corrosion resistance, mechanical fatigue, creep, ablation, and erosion, assessing their impact on material performance. Additionally, we evaluated innovative materials, including nanomaterials and composites, for enhanced durability. Experimental testing under simulated hypersonic conditions were computational modelling inform long-term performance predictions. Our study aimed to identify materials that withstand extreme thermal, mechanical, and environmental stresses during hypersonic flight, bridging traditional paradigms with AI-driven advancements.

Keywords: *hypersonic flight, material degradation, durability, wing tip materials, high temperature properties*