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PROBABILISTIC APPROACHES TO THE PREDICTION OF THE EFFECTS OF MULTIPLE PARAMETERS ON THE MECHANICAL PROPERTIES OF GAMMA-BASED TITANIUM ALUMINIDES

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Abstract

Multiple parameter expressions of the form, $Y = \alpha_o X_i^{\alpha} i$ (where α_o and a_i are empirically-derived exponents), are presented for the prediction of the effects of multiple parameters, X_i, on the mechanical properties, Y, of gamma-based titanium aluminides. The multiparameter expressions, obtained via multiple linear regression techniques, provide single functions for the prediction of the combined effects of composition, microstructure and temperature on basic mechanical properties such as yield/ultimate tensile strength, plastic strain to failure and fracture toughness. Approximate exponential reliability functions are also presented for the prediction of the probabilities of failure/survival at various possible stress/strain/stress intensity factor levels. The use of Bayes theorem is proposed for the improvement of the exponential reliability functions as more data becomes available. Simplified analytical methods are presented for the prediction of the combined errors of prediction. The paper highlights the need for multiparameter probabilistic mechanics approaches to the prediction of basic mechanical properties.