

Beta to alpha transformation kinetics and microstructure of Ti-6Al-4V alloy during continuous cooling

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Abstract: In the present paper, an approach based on the Kolmogorov-Johnson-Mehl-Avrami (KJMA) model has been developed and applied to study the transformation kinetics of the β phase in Ti-6Al-4V titanium alloy during cooling. To this purpose, Differential Scanning Calorimetry (DSC) tests have been conducted using a set of cooling rates ranging from 10 to 50 °C/min. This approach allows the kinetics parameters, particularly the activation energy, to be calculated from a single DSC test using a simple linear regression. The microstructural analysis indicates that the microstructure is dominated by the α Widmanstätten morphology (α_W). Microstructural observations along with the calculated values of the Avrami index and of the activation energy suggest that the growth of the α_W platelets obeys a mixed mode combining the vanadium diffusion and a displacive mechanism.

Keywords : Continuous cooling, KJMA model, additivity rule, diffusion, Displacive mechanism