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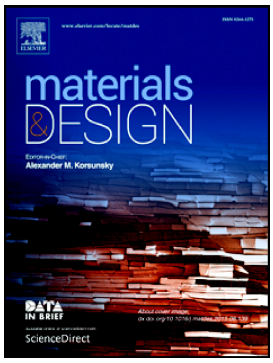

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PII: S0264-1275(16)31600-8
DOI: doi: 10.1016/j.matdes.2016.12.074
Reference: JMADE 2619

To appear in: *Materials & Design*

Received date: 3 July 2016
Revised date: 22 December 2016
Accepted date: 23 December 2016

Please cite this article as: Liang Zheng, T.L. Lee, Na Liu, Zhou Li, Guoqing Zhang, J. Mi, P.S. Grant , Numerical and physical simulation of rapid microstructural evolution of gas atomised Ni superalloy powders. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jmade(2016), doi: 10.1016/j.matdes.2016.12.074

Numerical and physical simulation of rapid microstructural evolution of gas atomised Ni superalloy powders

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Abstract

The rapid microstructural evolution of gas atomised Ni superalloy powder compacts over timescales of a few seconds was studied using a Gleeble 3500 thermomechanical simulator, finite element based numerical model and electron microscopies. The study found that the microstructural changes are governed by the characteristic temperatures of the alloy. At a temperature below the γ' solvus, the powders maintained the dendritic structures. Above the γ' solvus temperature but in the solid-state, rapid grain spheroidisation and coarsening occurred, although the fine-scale microstructures were largely retained. Once the incipient melting temperature of the alloy was exceeded, microstructural change was rapid, and when the temperature was increased into the solid+liquid state, the powder compact partially melted and then re-solidified with no trace of the original structure, despite the fast timescales. The study reveals the relationship between short, severe thermal excursions and microstructural evolution in powder processed components, and gives guidance on the upper limit of temperature

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