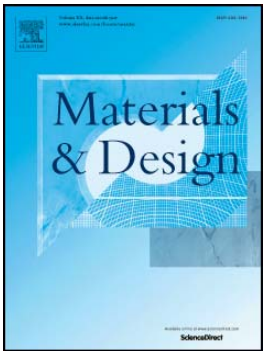

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PII: S0264-1275(15)30173-8
DOI: doi: 10.1016/j.matdes.2015.07.100
Reference: JMADE 328

To appear in:

Received date: 8 June 2015
Revised date: 16 July 2015
Accepted date: 18 July 2015

Please cite this article as: Gang Liu, Kehuan Wang, Binbin He, Mingxin Huang, Shijian Yuan, Mechanism of saturated flow stress during hot tensile deformation of a TA15 Ti alloy, (2015), doi: 10.1016/j.matdes.2015.07.100

Mechanism of saturated flow stress during hot tensile deformation of a TA15 Ti alloy

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Abstract

The recently developed high pressure gas forming technique can efficiently form parts of titanium alloys at a lower temperature with a higher strain rate as compared to the superplastic forming (SPF) technique. However, the deformation mechanism of titanium alloys at the temperatures suitable for high pressure gas forming is still not well understood. The deformation mechanism of a TA15 titanium alloy at 750 ^{o}C suitable for high pressure gas forming was investigated in the present work. It was found that the flow stress saturated after a true strain of 10% whilst the dislocation density was not saturated and increased continuously with straining. In addition, the Taylor factor was found to be nearly constant during tensile test. As a result, it is concluded that the α value, which represents the interaction between dislocations in the Taylor hardening model, decreases continuously with strain. It is worth noting that the α value in the Taylor hardening model is usually assumed to be a constant during tensile test in literature. The present work is the first one to report the dependence of α value on the strain for titanium alloys deformed at high temperatures of 750 $^{\circ}$C.

Keywords: Ti alloy; Hot deformation; Dislocation density; Nanoindentation;