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Model for m & Stress and Strain Rate of Superplastic Deformation in Ti_3Al Alloys

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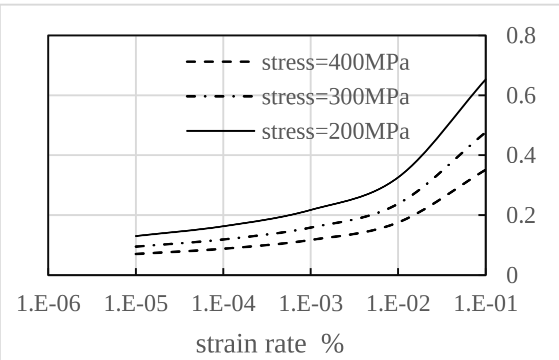
Abstract: *- The superplastic behavior is built to analyze the phenomenon of Ti_3Al. Through parameter change of stress, elongation & K m and flow stress is acquired. Through comparing with their value size it is found that stress and K will play an important role to m and flow stress respectively. Furthermore they are relationship in proportion to strain rate.*

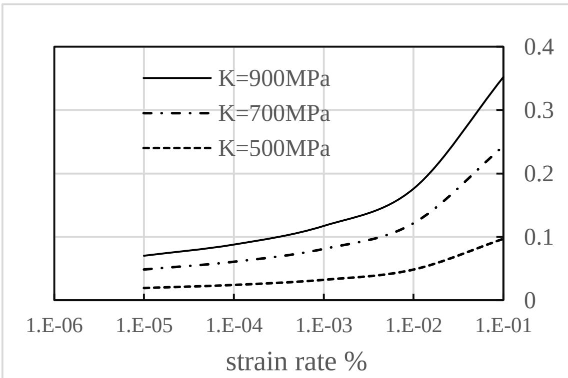
Keywords: *- model；superplastic deformation；m& flow stress；strain & K; Ti3Al*

1. Introduction

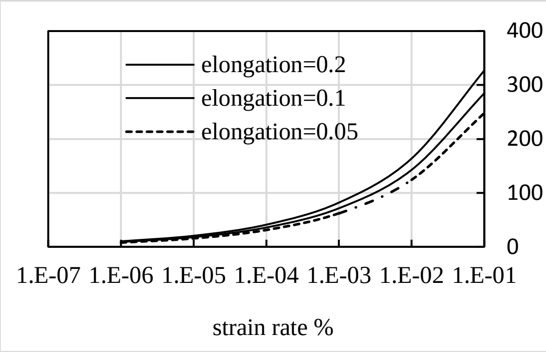
The relationship between strain rate sensitive exponent m& flow stress and strain rate in Ti3Al has not been systematically studied so far, so this paper calculates and compares the relationship among them to explore the mechanism of super plasticity. [1, 2] The m increases will cause even super plasticity. The turn of effective plasticity is m>K>n. furthermore strain rate and m& stress will Express this important parameter how it has relationship with super plasticity important parameter m and flow stress. Only if the parameter of strain rate is clarified can we determine other parameters for instance strain rate exponent m and flow stress value to find whether this super plasticity can form or not. We know that low flow stress will result in high plasticity. On the other hand high m will result in super plasticity if m >0.5 [3]



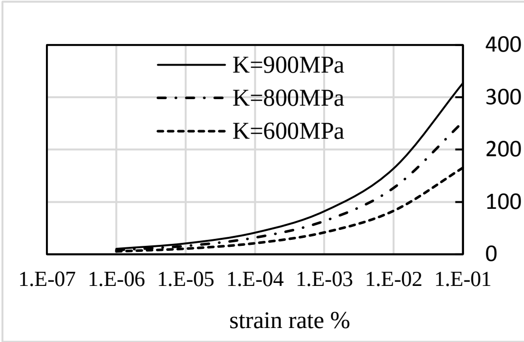
（a）m/σ



（b）m/K



(c) n/ε



(d) n/K

Figure 1 the relation between m & σ and $\dot{\varepsilon}$.

2 Model research

Now the numerical model is built as below turns. For the tensile test course

In terms of equation $\sigma = K\varepsilon^n$ --（1）

Take the logarithm it has $LN\sigma = LNK + nLN\varepsilon$ --（2）

In terms of equation too $\sigma = K_1 \dot{\varepsilon}^m$ --（3）

Here K is strength coefficient; n is strain hardening exponent; m is strain rate sensitive coefficient.

The same as above (2) it has $LN\sigma = LNK_1 + mLN\dot{\varepsilon}$ --（4）

from（1）&（2）it gains below two equations

$$n = \frac{LN(\sigma_1/\sigma_2)}{LN(\varepsilon_1/\varepsilon_2)} \text{ -- (5)}$$

$$K = EXP[LN\sigma_2 - \frac{LN(\sigma_1/\sigma_2)LN\varepsilon_2}{LN(\varepsilon_1/\varepsilon_2)}] \text{ -- (6)}$$

from（3）&（4）we gain below two equations too

$$m = \frac{LN(\sigma_1/\sigma_2)}{LN(\dot{\varepsilon}_1/\dot{\varepsilon}_2)} \text{ -- (7)}$$

$$K_1 = EXP[LN\sigma_2 - \frac{LN(\sigma_1/\sigma_2)LN\dot{\varepsilon}_2}{LN(\dot{\varepsilon}_1/\dot{\varepsilon}_2)}] \text{ -- (8)}$$

These (5-8) equations are the parameters resolution in tensile test.

2. Discussion & conclusions

As shown in Figure 1 (a, b) it shows that with the increasing strain rate $\dot{\varepsilon}$ the m increases. Meantime with the increasing stress σ and K m also increases as well. Through observation it has been found that K can play leading role to flow stress. Figure 1 (c, d) it shows that with the increasing strain rate $\dot{\varepsilon}$ the stress also increases while with the increasing elongation ε and K m increases too, which is another observation in this paper.

3. Conclusions

1. M value increases with the increase of K and stress. The stress plays a role to m in flow stress.
2. With the increase of elongation and K increases, stress decreases, indicating that K plays a role in increasing plasticity.

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