

Accepted Manuscript

A statistical theory of probability-dependent precipitation strengthening in metals and alloys

Qihong Fang , Li Li , Jia Li , Hongyu Wu , Zaiwang Huang ,
Bin Liu , Yong Liu , Peter K Liaw

PII: S0022-5096(18)30487-3
DOI: <https://doi.org/10.1016/j.jmps.2018.09.010>
Reference: MPS 3441



To appear in: *Journal of the Mechanics and Physics of Solids*

Received date: 8 June 2018
Revised date: 28 August 2018
Accepted date: 10 September 2018

Please cite this article as: Qihong Fang , Li Li , Jia Li , Hongyu Wu , Zaiwang Huang , Bin Liu , Yong Liu , Peter K Liaw , A statistical theory of probability-dependent precipitation strengthening in metals and alloys, *Journal of the Mechanics and Physics of Solids* (2018), doi: <https://doi.org/10.1016/j.jmps.2018.09.010>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

A statistical theory of probability-dependent precipitation strengthening in metals and alloys

Qihong Fang^a, Li Li^a, Jia Li^{a*}, Hongyu Wu^b, Zaiwang Huang^b, Bin Liu^b, Yong Liu^b, Peter K Liaw^c

^a *State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body, Hunan University, Changsha, 410082, PR China*

^b *State Key Laboratory of Powder Metallurgy, Central South University, Changsha, 410083, PR China*

^c *Department of Materials Science and Engineering, The University of Tennessee, Knoxville, TN 37996, USA*

* Corresponding author. E-mail address: lijia123@hnu.edu.cn (J. Li).

Abstract

The classical precipitation-strengthening models, described by either the Orowan mechanism or the cutting mechanism, rely on a single average size and dispersion of the precipitates obtained by the experimental observations. However, the continuous unimodal or multimodal size-distribution precipitates are formed in the alloy matrix, and always interact with dislocations via not only the looping mechanism but also the cutting mechanism although the precipitation size is larger than the critical size for determining the looping or cutting mechanism. Here, we propose a new precipitation-strengthening theory, which is a probability-dependent precipitation-strengthening mechanism, to more accurately predict the strengthening contribution of precipitates. The yielding strength obtained from the probability-dependent precipitation-strengthening model is in good agreement with the result of experiments, which is more accurately estimated, compared to the prediction of the classical precipitation-strengthening model, in particular, for the large precipitation size. In addition, the difference of the tensile strength from the classical model and our model comes

Download English Version:

<https://daneshyari.com/en/article/11027780>

Download Persian Version:

<https://daneshyari.com/article/11027780>

[Daneshyari.com](https://daneshyari.com)