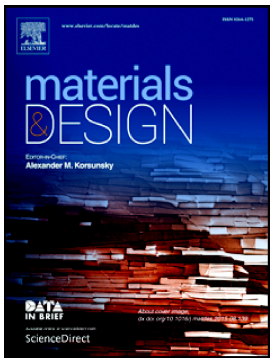
Accepted Manuscript



Nano-scale precipitates: The key to high strength and high conductivity in Al alloy wire

J.P. Hou, Q. Wang, Z.J. Zhang, Y.Z. Tian, X.M. Wu, H.J. Yang, X.W. Li, Z.F. Zhang

PII: S0264-1275(17)30651-2
DOI: doi: 10.1016/j.matdes.2017.06.062
Reference: JMADE 3180

To appear in: *Materials & Design*

Received date: 23 February 2017
Revised date: 23 June 2017
Accepted date: 27 June 2017

Please cite this article as: J.P. Hou, Q. Wang, Z.J. Zhang, Y.Z. Tian, X.M. Wu, H.J. Yang, X.W. Li, Z.F. Zhang , Nano-scale precipitates: The key to high strength and high conductivity in Al alloy wire, *Materials & Design* (2017), doi: 10.1016/j.matdes.2017.06.062

Nano-scale precipitates: The key to high strength and high conductivity in Al alloy wire

J. P. Hou [a,b], Q. Wang [a*], Z. J. Zhang [a], Y. Z. Tian [a], X. M. Wu [c], H. J. Yang [a], X. W. Li [b] and Z. F. Zhang [a*]

[a] *Shenyang National Laboratory for Materials Science, Institute of Metal Research, Chinese Academy of Sciences, 72 Wenhua Road, Shenyang 110016, P.R. China*

[b] *Department of Materials Physics and Chemistry, School of Materials Science and Engineering, Northeastern University, Shenyang 110819, P.R. China*

[c] *Electric Power Research Institute of Liaoning Electric Power Co., Ltd., Liaoning Electric Power Co., Ltd., Shenyang 110006, P.R. China*

Abstract

Outstanding mechanical and conductive properties are vital to Al alloys used as overhead conductors. However, high strength and high electrical conductivity are usually mutually exclusive in metallic materials. In this study, we present a novel method to achieve high strength and high conductivity in an Al-Mg-Si conductor. Numerous dispersive nano-scale precipitates were obtained using an artificial aging treatment for a 6201RE Al alloy conductor. The precipitation of the alloying elements in the form of nano-scale precipitates is determined to play a strengthening role, decreasing the concentration of alloying elements in the matrix and reduce lattice distortion such that high strength (352.3 MPa) and high electrical conductivity (56.0 %IACS) are achieved simultaneously in a 6201RE Al alloy. High strength and enhanced electrical conductivity could be achieved by introducing the nano-scale precipitates in the Al alloy. Finally, the strengthening mechanisms and the electrical

* Correspondence authors, Q. Wang and Z. F. Zhang, Tel: 0086-24-23971043, E-mail: gmwang@imr.ac.cn and zhfzhang@imr.ac.cn