

论文

含Fe和Mn的Ni₃₀Cu₇₀固溶体团簇模型与耐蚀性研究

张杰,王清,王英敏,董闯

大连理工大学三束材料改性教育部重点实验室, 大连 116024

摘要:

提出了一个极限固溶体合金的团簇模型,在此基础上优化设计了添加Fe和Mn的Ni₃₀Cu₇₀ (原子分数,\%)固溶体合金成分. 在该模型中,固溶的Fe和Mn以Ni为第一近邻形成12配位立方八面体原子团簇(Fe_{1-x}Mn_x)Ni₁₂而分散到Cu基体中,因此极限固溶体合金成分为 $[M_{1/13}Ni_{12/13}]_{30}Cu_{70} = [(Fe_{1-x}Mn_x)Ni_{12}]Cu_{30.3}$, $M = (Fe_{1-x}Mn_x)$. 采用X射线衍射和电化学腐蚀测试等方法,研究了[(Fe_{1-x}Mn_x)Ni₁₂]Cu_{30.3}合金的微观组织与耐腐蚀性能的关系. 实验结果表明,对应于极限固溶体状态的[(Fe_{0.75}Mn_{0.25})Ni₁₂]Cu_{30.3}合金,在3.5%NaCl溶液中具有相对好的耐腐蚀性能.

关键词: Cu-Ni合金 Fe(Mn)添加 固溶体模型 团簇结构 耐腐蚀性能

STUDY ON THE CLUSTER-BASED MODEL OF Ni₃₀Cu₇₀ SOLID SOLUTION WITH Fe AND Mn AND ITS CORROSION RESISTANCE

ZHANG Jie, WANG Qing, WANG Yingmin, DONG Chuang

Key Lab of Materials Modification by Laser, Ion and Electron Beams of Ministry of Education, School of Materials Science & Engineering, Dalian University of Technology, Dalian 116024

Abstract:

Minor Fe and Mn additions are necessary to enhance the corrosion resistance of commercial Cu-Ni alloys. The present paper aims at optimizing the addition amounts of Fe and Mn in Cu₇₀Ni₃₀ (atomic fraction, %) alloy using a cluster-based solid solution model. In this model it assumed that one Fe(Mn) atom and twelve Ni atoms formed a cluster consisted of Fe(Mn)-centered and Ni-surrounded cube-octahedron and the limit solid solution would be composed of isolated Fe(Mn)Ni₁₂ clusters embedded in the Cu matrix. The ratio of the Fe(Mn) atoms and its surrounding Ni atoms is 1:12, and the limit solid solution composition of Fe(Mn)-modified Cu₇₀Ni₃₀ alloy is $[M_{1/13}Ni_{12/13}]_{30}Cu_{70} = [(Fe_{1-x}Mn_x)Ni_{12}]Cu_{30.3}$, $M = (Fe_{1-x}Mn_x)$. The OM, XRD and electrochemical corrosion measurements were used to characterize the microstructure and corrosion resistance performance of [(Fe_{1-x}Mn_x)Ni₁₂]Cu_{30.3}. The results indicated that the solid solubility limitative alloys [(Fe_{0.75}Mn_{0.25})Ni₁₂]Cu_{30.3} has the best corrosion resistance in 3.5%NaCl aqueous solution.

Keywords: Cu-Ni alloy addition of Fe(Mn) solid solution model cluster structure corrosion-resistance

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通讯作者: 董闯

作者简介: 张杰, 男, 1979年生, 博士生

作者Email: dong@dlut.edu.cn

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