



ISSN 1004-0609
CODEN ZYJXFK

中国有色金属学报

The Chinese Journal of Nonferrous Metals

January 2016

Volume 26 Number 1

中国有色金属学会 主办
科学出版社 出版

目 次

结构材料

温变形对汽车车身用 6061 铝合金自然时效及力学性能的影响

.....李 翔, 唐建国, 张新明, 凌利月, 刘文辉, 廖志宇, 杨 涛, 邓运来(1)

新型 Al-Cu-Li-X 合金热处理强化及组织特征

.....李树飞, 尹登峰, 余鑫祥, 潘康观, 袁新雄, 房洪杰(7)

铜含量对 Al-50%Si_p 复合材料显微组织和力学性能的影响.....吴 翔, 王日初, 彭超群, 蔡志勇(16)

Zr 对挤压铸造 Al-5.0Cu-0.4Mn 合金显微组织和力学性能的影响.....孟凡生, 张卫文, 张大童, 杨 超, 肖志瑜(23)

超轻 Mg-Li-Al 系变形镁合金挤压板材的组织及性能.....李瑞红, 蒋 斌, 陈志军, 潘复生(31)

粉末特性对镍基粉末冶金高温合金组织及热变形行为的影响

.....何国爱, 丁晗晖, 刘琛仄, 刘 锋, 黄 岚, 江 亮(37)

镍基粉末高温合金原始颗粒边界形成及组织演化特征

.....秦子珺, 刘琛仄, 王 子, 何国爱, 刘 锋, 黄 岚, 江 亮(50)

过冷度对 Ni-Cu 合金枝晶偏析影响的相场法模拟.....侯超杰, 靳玉春, 赵宇宏, 侯 华, 佟乐乐(60)

层错能对铜合金室温变形及退火过程中晶粒细化的影响.....李 玮, 张祥凯, 何克坚, 杨续跃(66)

功能材料

铝及铝合金钎焊用硬钎料的研究现状与展望.....牛志伟, 黄继华, 许方钊, 刘凯凯, 陈树海, 赵兴科(77)

CrAlN 硬质刀具涂层的相结构稳定性及其热分解机制

.....张 健, 汤 旺, 毛 聪, 唐 昆, 余小峰, 龙春光, 彭 平(88)

不同调制周期 WS_x/a-C 多层膜的组织结构及摩擦学特性

.....杨芳儿, 史玉龙, 章 荣, 沈淑康, 鲁 叶, 郑晓华(96)

电子束蒸镀法制备 CuIn_{0.7}Ga_{0.3}Se₂ 薄膜太阳能电池的性能

.....王星星, 张福勤, 周 俊, 郑吉祥, 黎炳前, 刘 怡(103)

铅酸电池负极加碳后循环性能.....王练武, 王先友, 黄伟国, 童 庆, 王良勇(112)

研磨-煅烧法制备 WO₃/ZnS 异质结光催化剂及其光催化性能.....樊启哲, 余长林, 李家德, 李 鑫, 周晚琴(118)

W-30Cu 电接触材料直流电接触行为
.....万 成, 李继文, 王 展, 马竇琴, 张会杰, 魏世忠, 张国赏, 徐流杰(126)

矿业工程 • 冶金工程 • 化学与化工

河北平泉下金宝花岗斑岩锆石 U-Pb 年代学、Hf 同位素特征及其地质意义
.....张建国, 邵拥军, 刘忠法, 汪 程, 邹艳红, 李宏斌(137)

金川铜镍硫化物矿床铂族元素地球化学差异及其演化意义
.....曾认宇, 赖健清, 毛先成, 赵 莹, 刘 嫔, 朱佳玮, 岳 斌, 艾启兴(149)

响应曲面法优化复杂硫化铜矿选择性浸出工艺.....廖亚龙, 周 娟, 黄斐荣, 王祎洋(164)

基于混合整数规划法的采场回采顺序优化分析.....王李管, 任助理, 潘传鹏, 陈 鑫(173)

考虑管壁滑移效应膏体管道的输送阻力特性.....吴爱祥, 程海勇, 王贻明, 王洪江, 刘晓辉, 李公成(180)

氧气底吹炼铜多组元造钎行为及组元含量的映射关系.....王亲猛, 郭学益, 廖立乐, 田庆华, 张永柱(188)

锌冶炼中浸渣锌还原浸出机制与动力学.....张 纯, 闵小波, 张建强, 王 密, 李辕成(197)

原料添加顺序对氟盐法制备 Al-Ti-B 中间合金的影响.....廖成伟, 陈闻天, 陈 欢, 付建平, 潘春旭(204)

湿法炼锌沉铁渣和浸锌渣的焙烧预处理
.....刘 洋, 谭 军, 尹周澜, 刘常青, 陈启元, 张平民, 廖 舟, 王心皞(212)

低品位铂钯精矿的富氧压浸出.....刘志强, 王 伍, 曹洪杨, 周向前, 张魁芳, 邱显扬(223)

耐铀颗粒污泥微生物群落结构解析.....曾涛涛, 鲁慧珍, 刘迎九, 刘金香, 荣丽杉, 马华龙, 谢水波(233)

投稿须知.....(242)

责任编辑: 龙怀中, 李艳红, 王 超

[期刊基本参数] CN43—1238/TG*1991*m*A4*242*zh*P*¥80.0*1400*27*2016-01

CONTENTS

Structural Materials

Effect of warm deformation on natural ageing and mechanical property of aluminum alloy 6061 sheets for automotive body.....LI Xiang, TANG Jian-guo, ZHANG Xin-ming, LING Li-yue, LIU Wen-hui, LIAO Zhi-yu, YANG Tao, DENG Yun-lai(6)

Heat treatment strengthening and microstructure characteristics of novel Al-Cu-Li-X alloyLI Shu-fei, YIN Deng-feng, YU Xin-xiang, PAN Kang-guan, YUAN Xin-xiong, FANG Hong-jie(15)

Effects of Cu content on microstructures and mechanical properties of Al-50%Si_p compositeWU Xiang, WANG Ri-chu, PENG Chao-qun, CAI Zhi-yong(22)

Effect of Zr on microstructures and mechanical properties of squeeze cast Al-5.0Cu-0.4Mn alloyMENG Fan-sheng, ZHANG Wei-wen, ZHANG Da-tong, YANG Chao, XIAO Zhi-yu(30)

Microstructure and mechanical properties of as-extruded ultra-light Mg-Li-Al sheetLI Rui-hong, JIANG Bin, CHEN Zhi-jun, PAN Fu-sheng(36)

Effects of powder characteristics on microstructure and deformation activation energy of nickel based superalloyHE Guo-ai, DING Han-hui, LIU Chen-ze, LIU Feng, LAN Huang, JIANG Liang(49)

Formation and microstructure evolution of precipitation on prior particle boundaries in P/M nickel-base superalloysQIN Zi-jun, LIU Chen-ze, WANG Zi, HE Guo-ai, LIU Feng, HUANG Lan, JIANG Liang(59)

Numerical simulation for influence of super-cooling degree by phase-field method on microsegregation of nickel-copper alloy.....HOU Chao-jie, JIN Yu-chun, ZHAO Yu-hong, HOU Hua, TONG Le-le(65)

Effect of stack fault energy on grain refinement of Cu alloy during room temperature deformation and subsequent annealing.....LI Yi, ZHANG Xiang-kai, HE Ke-jian, YANG Xu-yue(76)

Functional Materials

Current research status and prospect of brazing filler metals for aluminum and aluminum alloysNIU Zhi-wei, HUANG Ji-hua, XU Fang-zhao, LIU Kai-kai, CHEN Shu-hai, ZHAO Xing-ke(87)

Phase structure stability and thermal decomposition mechanism of CrAlN hard cutting tool coatingZHANG Jian, TANG Wang, MAO Cong, TANG Kun, YU Xiao-feng, LONG Chun-guang, PENG Ping(95)

Microstructure and tribological properties of WS_x/a-C multilayer films with various modulation periodsYANG Fang-er, SHI Yu-long, ZHANG Rong, SHEN Shu-kang, LU Ye, ZHENG Xiao-hua(102)

Characterization of CuIn_{0.7}Ga_{0.3}Se₂ films prepared by electron-beam evaporation for thin film solar cellWANG Xing-xing, ZHANG Fu-qin, ZHOU Jun, ZHENG Ji-xiang, LI Bing-qian, LIU Yi(111)

Cyclic performance of negative electrode doped with carbon for lead-acid batteryWANG Lian-wu, WANG Xian-you, HUANG Wei-guo, TONG Qing, WANG Liang-yong(117)

WO₃/ZnS heterostructured photocatalysts prepared by grinding-calcination method and
their photocatalytic performance.....FAN Qi-zhe, YU Chang-lin, LI Jia-de, LI Xin, ZHOU Wan-qin(125)

Electrical contact behavior of W-30Cu contact material under direct current condition
.....WAN Cheng, LI Ji-wen, WANG Zhan, MA Dou-qin, ZHANG Hui-jie,
WEI Shi-zhong, ZHANG Guo-shang, XU Liu-jie(136)

Mine Engineering, Metallurgical Engineering, Chemistry and Chemical Engineering

Zircon U-Pb geochronology and Hf isotope characteristics of Xiaojinbao granite-porphyry body, Hebei Province,
and its geological significance.....ZHANG Jian-guo, SHAO Yong-jun, LIU Zhong-fa,
WANG Chen, ZOU Yan-hong, LI Hong-bin(148)

Distinction of platinum group elements geochemistry in Jinchuan Cu-Ni sulfide deposit and its implication for
magmatic evolution.....ZENG Ren-yu, LAI Jian-qing, MAO Xian-cheng,
ZHAO Yin, LIU Pin, ZHU Jia-wei, YUE Bin, AI Qi-xing(163)

Optimization of selective leaching technology of complex sulfide copper ore by response surface methodology
.....LIAO Ya-long, ZHOU Juan, HUANG Fei-rong, WANG Yi-yang(172)

Optimization analysis of stope mining sequence based on mixed integer programming
.....WANG Li-guan, REN Zhu-li, PAN Chuan-peng, CHEN Xin(179)

Transport resistance characteristic of paste pipeline considering effect of wall slip
.....WU Ai-xiang, CHENG Hai-yong, WANG Yi-ming, WANG Hong-jiang, LIU Xiao-hui, LI Gong-cheng(187)

Mapping relationship between multicomponent matte forming behavior and content in copper oxygen bottom
blowing bath smelting process.....WANG Qin-meng, GUO Xue-yi, LIAO Li-le,
TIAN Qing-hua, ZHANG Yong-zhu(196)

Mechanisms and kinetics on reductive leaching of zinc from zinc neutral leaching residue
.....ZHANG Chun, MIN Xiao-bo, ZHANG Jian-qiang, WANG Mi, LI Yuan-cheng(203)

Effect of feeding order on preparation of Al-Ti-B master alloy by fluoride salt method
.....LIAO Cheng-wei, CHEN Wen-tian, CHEN Huan, FU Jian-ping, PAN Chun-xu(211)

Roasting pretreatment of iron-sinking slag and zinc leaching residue in zinc hydrometallurgy
.....LIU Yang, TAN Jun, YIN Zhou-lan, LIU Chang-qing, CHEN Qi-yuan,
ZHANG Ping-min, LIAO Zhou, WANG Xin-hao(222)

Oxygen pressure leaching of low-grade Pt-Pd concentrate
.....LIU Zhi-qiang, WANG Wu, CAO Hong-yang, ZHOU Xiang-qian, ZHANG Kui-fang, QIU Xian-yang(232)

Analysis of microbial community structure of ranium-resistant granular sludge
.....ZENG Tao-tao, LU Hui-zhen, LIU Ying-jiu, LIU Jin-xiang, RONG Li-shan, MA Hua-long, XIE Shui-bo(241)

Information for contributors.....(242)

(Managing Editors: LONG Huai-zhong, LI Yan-hong, WANG Chao)

中国有色金属学报

(ZHONGGUO YOUSE JINSHU XUEBAO)

(月刊, 1991 年创刊)

第 26 卷第 1 期(总第 202 期) 2016 年 1 月出版

The Chinese Journal of
Nonferrous Metals

(Monthly, Started in 1991)

Volume 26 Number 1 (Sum 202), January 2016

主 管: 中国科学技术协会
主 办: 中国有色金属学会
承 办: 中南大学
主 编: 黄伯云
副主编: 邱冠周, 彭超群
编辑部主任: 龙怀忠
编辑部副主任: 何学锋
编 辑: 《中国有色金属学报》编辑部
410083 湖南省长沙市中南大学内
电 话: (0731)88876765, 88877197
传 真: (0731)88877197
E-mail: f-ysxb@csu.edu.cn
http://www.ysxbcn.com
http://www.tnmsc.cn
出 版: 科 学 出 版 社
100717 北京东黄城根北街 16 号
印 刷: 湖南农科院印刷厂
国内发行: 长沙市报刊发行局
邮发代号: 42-218
国外发行: 中国国际图书贸易总公司
(北京 399 信箱)

Superintended by China Association for Science and
Technology
Sponsored by The Nonferrous Metals Society of China
Managed by Central South University
Chief Editor: HUANG Bai-yun
Deputy Chief Editors: QIU Guan-zhou
PENG Chao-qun
Editorial Director: LONG Huai-zhong
Deputy Editorial Director: HE Xue-feng
Edited by Editorial Office of
The Chinese Journal of Nonferrous Metals
(Central South University,
Changsha, Hunan 410083, China)
Fax: +86-731-88877197
E-mail: f-ysxb@csu.edu.cn
http://www.ysxbcn.com
http://www.tnmsc.cn
Published by Science Press
(16 Donghuangchenggen North Street,
Beijing 100717, China)
Distributed abroad by
China International Book Trading Corporation
(P. O. Box 399, Beijing, China)

ISSN 1004-0609 80 元/册
CN 43-1238/TG 国内定价: 960 元/年
国 内 外 公 开 发 行

ISSN 1004-0609

