



ISSN 1004-0609  
CN 43-1238/TG  
CODEN ZYJXFK

# 中国有色金属学报

The Chinese Journal of Nonferrous Metals

---

March 2023

---

Volume 33 Number 3

---

中国科学技术协会 主管  
中国有色金属学会 主办

## 目 次

## 材料科学与工程

- Nd和Gd对Mg-3Al合金的细晶行为及影响机理 ..... 刘权,肖祁陵,罗群,李谦,周国治(653)  
晶粒尺寸对生物医用Mg-3Zn-0.2Ca-0.2Mn合金降解行为的影响  
..... 崔珠殷,李淑波,付军健,刘轲,王朝辉,杜文博(665)  
中等应变速率轧制制备多尺度混晶镁合金工艺及组织性能  
..... 刘筱,杨伟成,朱必武,吴远志,唐昌平,刘文辉,宋宇峰(678)  
Cu添加对Mg-Bi合金铸态组织和沉淀硬化的影响 ..... 周菁菁,杨文朋,陈亮,崔红保,郭学锋(689)  
退火对黄铜包覆纯铜绞线组织和力学性能的影响 ..... 雷宇,李永帅,姜雁斌,赵帆,刘新华,谢建新(702)  
铜元素含量对超高强铝合金力学性能淬火敏感性的影响 ..... 张梦晗,刘胜胆,蒋靖宇,马志民,韦卫昌(715)  
旋锻复合铜包镀铜线材的组织性能 ..... 万金风,赵帆,刘新华(729)  
Sc掺杂TiB<sub>2</sub>/6061复合材料热变形行为及热加工图 ..... 解佩佩,陈咪,刘志伟,余申卫,何源,贾豫冬(741)  
电磁冲击对TC11钛合金叶片疲劳性能的影响  
..... 孙倩,孙向阳,宋燕利,钱东升,华林,王自成,邱冬生(752)  
Ti-55511合金显微组织对其高温疲劳行为的影响  
..... 陈宇强,贺梓泯,潘素平,刘会群,伏明珠,付永杰,李佳(767)  
基于多轴载荷相位差的神经网络预测钛合金疲劳寿命 ..... 郑战光,张剑,孙腾,谢昌吉,黄增(781)  
Ni、Fe含量对90Mo-Ni-Fe合金性能的影响 ..... 刘俊汝,张国华,周国治(792)  
静电悬浮深过冷熔融锆形核凝固测量 ..... 陆潇晓,张明辉,刘晓珂,王艳秋,郑福,孙志斌(804)  
锂离子电池热模型研究进展 ..... 张杭,云凤玲,沈雪玲,崔义,闫坤,方彦彦(817)  
以Si-CaO/Al<sub>2</sub>O<sub>3</sub>-Si为连接层的C/C复合材料扩散连接接头微观组织及其剪切强度  
..... 贾建刚,高康博,王晓昱(829)  
非连续金刚石/Ta基碳化物复合涂层结构及性能  
..... 曹锋,高洁,刘红军,王永胜,黑鸿君,于盛旺,刘克昌(839)

## 冶金工程·矿业工程·化学化工

- 铝电解槽双端节能理论及工业应用 ..... 梁学民, 冯冰, 曹志成, 孔亚鹏, 陈昱冉, 何季麟(850)
- 硫化锑精矿  $\text{CO}_2$  顶吹固硫熔炼新工艺 ..... 丁瑞泽, 杨建广, 朱强, 南天翔, 谢雪珍, 叶有明(862)
- 含钴转炉渣非熔融选择性还原回收钴  
..... 张文娟, 文培成, 朱纪念, 陈国举, 车键勇, 陈军, 夏柳, 王成彦(873)
- $\text{CeCl}_3$  对工业电解液中钴电沉积层的晶粒细化作用 ..... 徐仰涛, 代靖民, 裴亮, 杜海洋, 王超(886)
- 全因子实验设计废弃光伏组件中铝和银的浸出 ..... 李炜垚, 焦芬, 陈琛, 覃文庆, 刘维(898)
- 复合烃油对不同粒级辉钼矿的浮选强化机理及应用  
..... 刘润清, 李杰, 宋鑫, 王长涛, 陈臣, 张庆鹏, 孙伟(912)
- 不同气氛下白云鄂博铌铁矿固相转化热力学研究 ..... 卢翔, 陈雯, 姜楚灵(922)
- 湖南邓阜仙矿田隐爆角砾岩与钨锡成矿关系  
..... 康凡, 李欢, 刘飚, 吴堑虹, 孔华, 奚小双, 谭富诚(931)
- 开挖卸荷-射孔压裂下高应力硬岩的应力分布与裂纹扩展 .... 陈正红, 陈秋南, 李夕兵, 吴秋红, 黄小城(952)

责任编辑：李艳红，何学锋，龙怀中

[期刊基本参数] CN 43-1238/TG\*1991\*m\*A4\*316\*zh\*P\*¥80.0\*720\*25\*2023-03

**The Chinese Journal of Nonferrous Metals**  
**(ZHONGGUO YOUSE JINSHU XUEBAO)**

Volume 33 Number 3

(Sum 288)

March 2023

**CONTENTS**

**Materials Science and Engineering**

- Grain refinement behavior and influence mechanism of Nd and Gd on Mg-3Al alloy ..... LIU Quan, XIAO Qi-ling, LUO Qun, LI Qian, CHOU Kuo-chih(653)
- Effect of grain size on degradation behavior of Mg-3Zn-0.2Ca-0.2Mn alloy for biomedical application ..... CUI Zhu-yin, LI Shu-bo, FU Jun-jian, LIU Ke, WANG Zhao-hui, DU Wen-bo(665)
- Medium-strain rate rolling process for multi-scale mixed-crystal magnesium alloy and its microstructure and mechanical property ..... LIU Xiao, YANG Wei-cheng, ZHU Bi-wu, WU Yuan-zhi, TANG Chang-ping, LIU Wen-hui, SONG Yu-feng(678)
- Effects of Cu addition on as-cast microstructure and precipitation hardening of Mg-Bi alloy ..... ZHOU Jing-jing, YANG Wen-peng, CHEN Liang, CUI Hong-bao, GUO Xue-feng(689)
- Effects of annealing on microstructure and mechanical properties of brass clad copper stranded wire ..... LEI Yu, LI Yong-shuai, JIANG Yan-bin, ZHAO Fan, LIU Xin-hua, XIE Jian-xin(702)
- Effect of Cu content on quenching sensitivity relative to mechanical properties of ultra-high strength aluminum alloy ..... ZHANG Meng-han, LIU Sheng-dan, JIANG Jing-yu, MA Zhi-min, WEI Wei-chang(715)
- Microstructure and properties of copper-clad beryllium copper wire fabricated by rotary swaging ..... WAN Jin-feng, ZHAO Fan, LIU Xin-hua(729)
- Hot deformation behavior and hot processing map of Sc doped TiB<sub>2</sub>/6061 composite ..... XIE Pei-pei, CHEN Mi, LIU Zhi-wei, YU Shen-wei, HE Yuan, JIA Yu-dong(741)
- Effect of electromagnetic shock on fatigue performance of TC11 titanium alloy blade ..... SUN Qian, SUN Xiang-yang, SONG Yan-li, QIAN Dong-sheng, HUA Lin, WANG Zi-cheng, QIU Dong-sheng(752)
- Influence of microstructure of Ti-55511 alloy on its fatigue behavior at high temperature ..... CHEN Yu-qiang, HE Zi-min, PAN Su-ping, LIU Hui-qun, FU Ming-zhu, FU Yong-jie, LI Jia(767)
- Multi-axial fatigue life prediction of titanium alloy based on neural network of load phase difference ..... ZHENG Zhan-guang, ZHANG Jian, SUN Teng, XIE Chang-ji, HUANG Zeng(781)
- Effects of Ni and Fe contents on properties of 90Mo-Ni-Fe alloy ..... LIU Jun-ru, ZHANG Guo-hua, CHOU Kuo-chih(792)
- Nucleation and solidification measurement of deep-undercooling molten zirconium under electrostatic levitation ..... LU Xiao-xiao, ZHANG Ming-hui, LIU Xiao-ke, WANG Yan-Qiu, ZHENG Fu, SUN Zhi-bin(804)
- Research progress on thermal model of lithium ion battery ..... ZHANG Hang, YUN Feng-ling, SHEN Xue-ling, CUI Yi, YAN Kun, FANG Yan-yan(817)

- Microstructure and shear strength of diffusion joint of C/C composite using Si-CaO/Al<sub>2</sub>O<sub>3</sub>-Si as interlayer ..... JIA Jian-gang, GAO Kang-bo, WANG Xiao-yu(829)
- Structure and properties of discontinuous diamond/Ta-based carbide composite coating ..... CAO Feng, GAO Jie, LIU Hong-jun, WANG Yong-sheng, HEI Hong-jun, YU Sheng-wang, LIU Ke-chang(839)

## **Metallurgical Engineering, Mine Engineering, Chemistry and Chemical Engineering**

- Aluminum electrolytic cell double-ports energy-saving theory and industrial application ..... LIANG Xue-min, FENG Bing, CAO Zhi-cheng, KONG Ya-peng, CHEN Yu-ran, HE Ji-lin(850)
- Sulfur-fixation smelting process for antimony sulfide concentrate by CO<sub>2</sub> top blowing ..... DING Rui-ze, YANG Jian-guang, ZHU Qiang, NAN Tian-xiang, XIE Xue-zhen, YE You-ming(862)
- Selective reduction and recovery of cobalt from cobalt-bearing converter slag via non-molten reduction ..... ZHANG Wen-juan, WEN Pei-cheng, ZHU Ji-nian, CHEN Guo-ju, CHE Jian-yong, CHEN Jun, XIA Liu, WANG Cheng-yan(873)
- Grain refinement of cobalt electrodeposited layers in industrial electrolytes by CeCl<sub>3</sub> ..... XU Yang-tao, DAI Jing-min, PEI Liang, DU Hai-yang, WANG Chao(886)
- Full-factorial experimental design for leaching of aluminum and silver from waste photovoltaic modules ..... LI Wei-yao, JIAO Fen, CHEN Chen, QIN Wen-qing, LIU Wei(898)
- Flotation enhancing mechanism and application of compound hydrocarbon oil on molybdenites with different particle sizes ..... LIU Run-qing, LI Jie, SONG Xin, WANG Chang-tao, CHEN Chen, ZHANG Qing-peng, SUN Wei(912)
- Thermodynamics study on solid-phase transformation of columbite in Bayan Obo deposit under different atmospheres ..... LU Xiang, CHEN Wen, JIANG Chu-ling(922)
- Relationship between cryptoexplosive breccia and W-Sn mineralization in Dengfuxian ore field, Hunan Province ..... KANG Fan, LI Huan, LIU Biao, WU Qian-hong, KONG Hua, XI Xiao-shuang, TAN Fu-cheng(931)
- Stress distribution and crack propagation of high stress hard rock under excavation unloading-perforation fracturing ..... CHEN Zheng-hong, CHEN Qiu-nan, LI Xi-bing, WU Qiu-hong, HUANG Xiao-cheng(952)