



ISSN 1000-6931  
CN 11-2044/TL

# 原子能科学技术

中国原子能科学研究院

2018 **2** (第52卷)

ATOMIC ENERGY SCIENCE  
AND TECHNOLOGY

ATOMIC ENERGY SCIENCE  
AND TECHNOLOGY

ISSN 1000-6931



9 771000 693189

万方数据

YUANZINENG KEXUE JISHU



目 次

中国原子能科学研究院第 31 届“五四”青年学术报告会论文选

纳滤处理重铀酸铵沉淀母液的研究 ..... 袁中伟,汪润慈,晏大红,郑卫芳(193)

用于双离子束注入器的杂质消除系统 ..... 唐 兵,王鲁闽,马瑞刚,李 宁,陈立华,曹留焯,黄青华,张 建,崔保群,冉 广,马鹰俊,黄子敬,马 燮(199)

基于 CRAM 的压水堆燃耗程序开发及验证 ..... 成昱廷,周 琦,朱庆福,于 超(204)

316 不锈钢激光焊接中离焦量对热裂纹的影响 ..... 张国栋,郑剑平,赵 俊,张 征,王振东,梁 娜(210)

物理

<sup>252</sup>Cf 裂变  $\gamma$  射线伴随飞行时间法刻度液体闪烁体中子探测效率 ..... 任 杰,聂阳波,阮锡超,黄翰雄,李 霞,张 凯(215)

局部驱动螺旋电流对撕裂模不稳定性的影响 ..... 袁 赟,路兴强,龚学余,尹陈艳,陈诗佳(221)

化学

铀矿石酸化-细菌柱浸的动力学分析 ..... 刘玉龙,李广悦,王有团,胡 南,喻 清,马 亮,丁德馨(227)

碱性铀矿石电化学浸出技术初步研究 ..... 樊 兴,康绍辉,李大炳,宋 艳,李建华(235)

Pt 催化 N<sub>2</sub>H<sub>4</sub> 还原 U(VI) 制备 U(IV) 过程中 N<sub>2</sub>H<sub>4</sub> 断键机制研究 ..... 张晓腾,李 斌,周贤明,刘利生,郝 帅,蒋冬梅,夏良树(240)

ESR 法研究 Pt 催化 N<sub>2</sub>H<sub>4</sub> 分解机制 ..... 郝 帅,李 斌,周贤明,刘利生,张晓腾,蒋冬梅,夏良树(247)

反应堆工程

高温气冷堆堆芯主动冷却过程动态分析 ..... 朱光宇,朱宏晔,居怀明,杨星团,黄晓津,姜胜耀(255)

起伏振动状态下倾斜管气液两相流型实验研究 ..... 周云龙,李珊珊(262)

蒸汽发生器传热管在泵致脉动压力载荷下的动力学响应研究 ..... 蔡逢春,黄 旋,沈平川,叶献辉(269)

安全壳静水中的屈曲临界深度分析 ..... 胡锦涛,张乃樑,郭 健,董 斌,滕洪园(276)

UN 核芯 TRISO 包覆燃料颗粒性能分析 ..... 李 伟,武小莉,刘仕超,王 璐,苗一非,唐昌兵,李文杰,陈 平(283)

N36 锆合金包壳堆内腐蚀模型研究 ..... 苗一非,焦拥军,张 坤,邢 硕,陈 平,吕亮亮,刘振海(290)

压水堆燃料包壳锆同位素共振计算研究 ..... 张宏博,汤春桃,杨伟焱,杨 波(295)

跳源法测量 ADS 启明星 II 号的次临界度及动态特性 ..... 梁淑红,朱庆福,史永谦,周 琦,罗皇达(302)

JFNK 求解高温气冷堆中子扩散问题的预处理方法研究 ..... 卢佳楠,郭 炯,李 富(307)

基于 SWT 和 Hilbert 的密封磁阻马达式 CRDM 振动信号去噪 .....	石 磊,陈 玲,张黎明(314)
钠冷快堆棒状燃料堆芯子通道分析程序开发及验证 .....	张松梅,张东辉(320)
核电厂数字化主控室操纵员的响应计划可靠性评估模型 .....	李鹏程,张 力,戴立操,蒋建军(326)

## 技术及应用

空间粒子辐射 LET 谱的中低轨道卫星实测结果及误差分析 .....	袁 斌,张坤毅,张斌全,常 峥,沈国红,孙 莹,荆 涛,孙越强,刘 杰,王建松(334)
介质材料内部充电特性模拟仿真与试验研究 .....	安 恒,薛玉雄,杨生胜,王 俊,张晨光(340)
X 射线编码孔成像技术在近地太空核爆探测中的应用 .....	董文斌,邹士亚,周红召,孙 勇,李海俊,李小强,张 雄(345)
X 射线管焦点尺寸测量方法研究 .....	张 催,潘小东,商宏杰,蒲永凡,李公平(353)
230 MeV 质子回旋加速器超导线圈力学分析及固化工艺研究 .....	尹 蒙,王 川,张天爵,张素平,张喜虎,郭如勇,吕银龙,崔 涛,成 渝(359)
Gd <sub>2</sub> O <sub>3</sub> :Ce 闪烁体中子探测性能测试与改进研究 .....	王中庆,黄跃峰,李勇平(365)
一种新型溴化铯闪烁体探测器性能研究 .....	周倩倩,侯越云,梁珺成,张春生,王仁波(371)
电子束辐照对生湿面条杀菌效果及品质影响的研究 .....	史依沫,王 丽,李淑荣,张春红,张卫东,徐毓谦,汪慧华,刘小飞,马长路,潘 妍,高美须(378)

期刊基本参数: CN 11-2044 / TL \* 1959 \* m \* A4 \* 192 \* zh \* P \* ¥40.00 \* 1200 \* 30 \* 2018-02

本期责任编辑 侯翠梅 马英霞 王宝金 王调霞 汤晓浩 张秀平 韩翠娥

## CONTENTS

### SELECTED PAPERS OF THE 31th MAY FOUR YOUNG SCIENTISTS SYMPOSIUM HELD IN CHINA INSTITUTE OF ATOMIC ENERGY

Treatment of Ammonium Diuranate Mother Liquor by Nanofiltration .....  
 ..... YUAN Zhongwei, WANG Runci, YAN Taihong, ZHENG Weifang (193)

Study on Impurity Elimination System for Dual-beam Accelerator .....  
 ..... TANG Bing, WANG Lumin, MA Ruigang, LI Ning, CHEN Lihua, CAO Liuxuan,  
 HUANG Qinghua, ZHANG Jian, CUI Baoqun, RAN Guang, MA Yingjun, HUANG Zijing, MA Xie (199)

Development and Verification of PWR Burnup Code Based on CRAM .....  
 ..... CHENG Yuting, ZHOU Qi, ZHU Qingfu, YU Chao (204)

Effect of Defocusing Amount on Hot Cracking in Laser Welding of 316 Stainless Steel .....  
 ... ZHANG Guodong, ZHENG Jianping, ZHAO Jun, ZHANG Zheng, WANG Zhendong, LIANG Na (210)

### PHYSICS

Calibration of Neutron Detection Efficiency for Liquid Scintillator with <sup>252</sup>Cf Fission Gamma Ray and Time-of-Flight Method .....  
 ..... REN Jie, NIE Yangbo, RUAN Xichao, HUANG Hanxiong, LI Xia, ZHANG Kai (215)

Effect of Local Driving Helical Current on Tearing Mode Instability .....  
 ..... YUAN Yun, LU Xingqiang, GONG Xueyu, YIN Chenyan, CHEN Shijia (221)

### CHEMISTRY

Kinetic Analysis of Uranium Ore in Acidification and Bacteria Column Leaching .....  
 ..... LIU Yulong, LI Guangyue, WANG Youtuan, HU Nan, YU Qing, MA Liang, DING Dexin (227)

Initial Study on Electrochemical Leaching Process of Alkaline Uranium Ore .....  
 ..... FAN Xing, KANG Shaohui, LI Dabing, SONG Yan, LI Jianhua (235)

Study on Bond Breaking Mechanism for Process of U (IV) Produced by N<sub>2</sub>H<sub>4</sub> Reducing U (VI) with Platinum as Catalyst .....  
 ZHANG Xiaoteng, LI Bin, ZHOU Xianming, LIU Lisheng, HAO Shuai, JIANG Dongmei, XIA Liangshu (240)

Mechanism of Pt-catalyzed N<sub>2</sub>H<sub>4</sub> Decomposition by ESR Method .....  
 HAO Shuai, LI Bin, ZHOU Xianming, LIU Lisheng, ZHANG Xiaoteng, JIANG Dongmei, XIA Liangshu (247)

### REACTOR ENGINEERING

Transient Analysis of Active Cooling Procedure of HTR Reactor Core .....  
 ZHU Guangyu, ZHU Hongye, JU Huaiming, YANG Xingtuan, HUANG Xiaojin, JIANG Shengyao (255)

Experiment Investigation on Gas-liquid Two-phase Flow Pattern in Inclined Pipe under Fluctuant Vibration Condition .....  
 ..... ZHOU Yunlong, LI Shanshan (262)

Study on Dynamic Response of Steam Generator Heat Transfer Tube under Pump-induced Pressure Pulsation .....  
 ..... 万方数据 CAI Fengchun, HUANG Xuan, SHEN Pingchuan, YE Xianhui (269)

Critical Buckling Depth Analysis of Safety Shell under Hydrostatic Pressure .....	.....
.....	..... HU Jinwen, ZHANG Nailiang, GUO Jian, DONG Bin, TENG Hongyuan(276)
Performance Analysis of TRISO Coated Fuel Particle with UN Kernel .....	.....
.....	..... LI Wei, WU Xiaoli, LIU Shichao, WANG Lu, MIAO Yifei, TANG Changbing, LI Wenjie, CHEN Ping(283)
In-pile Corrosion Model Research of N36 Zirconium Alloy Cladding .....	.....
.....	..... MIAO Yifei, JIAO Yongjun, ZHANG Kun, XING Shuo, CHEN Ping, LYU Liangliang, LIU Zhenhai(290)
Study on Resonance Self-shielding Calculation for Zirconium Isotope in PWR Fuel Cladding .....	.....
.....	..... ZHANG Hongbo, TANG Chuntao, YANG Weiyang, YANG Bo(295)
Sub-critical Reactivity and Dynamic Characteristic Measured by Source-jerk Method on VENUS-II .....	.....
.....	..... LIANG Shuhong, ZHU Qingfu, SHI Yongqian, ZHOU Qi, LUO Huangda(302)
Preconditioning Method for JFNK on Solving HTGR Neutron Diffusion Problem .....	.....
.....	..... LU Jianan, GUO Jiong, LI Fu(307)
De-noising of Vibration Signal of Sealed Magnetostrictive Motor CRDM Based on Semi-soft Wavelet Threshold and Hilbert Transformation .....	.....
.....	..... SHI Lei, CHEN Ling, ZHANG Liming(314)
Development and Verification of Sub-channel Analysis Code for Solid Fuel Core of Sodium Cooling Fast Reactor .....	.....
.....	..... ZHANG Songmei, ZHANG Donghui(320)
Assessment Model of Operator's Response Planning Reliability in Digital Main Control Room of Nuclear Power Plant .....	.....
.....	..... LI Pengcheng, ZHANG Li, DAI Licao, JIANG Jianjun(326)

## TECHNIQUES AND APPLICATIONS

Analysis of Space Particle Radiation LET Spectra Detecting Result in MEO /LEO and Its Error .....	.....
.....	..... YUAN Bin, ZHANG Shenyi, ZHANG Binquan, CHANG Zheng, SHEN Guohong, SUN Ying, JING Tao, SUN Yueqiang, LIU Jie, WANG Jiansong(334)
Simulation and Investigation of Deep Charging Characteristic for Dielectric Material .....	.....
.....	..... AN Heng, XUE Yuxiong, YANG Shengsheng, WANG Jun, ZHANG Chengguang(340)
Application of X-ray Coded Aperture Imaging Technology in Near-earth Space Nuclear Explosion Detection .....	.....
.....	..... DONG Wenbin, ZOU Shiya, ZHOU Hongzhao, SUN Yong, LI Haijun, LI Xiaoqiang, ZHANG Xiong(345)
Study on Innovative Method for Measuring Focal Spot Size of X-ray Tube .....	.....
.....	..... ZHANG Cui, PAN Xiaodong, SHANG Hongjie, PU Yongfan, LI Gongping(353)
Mechanical Analysis and Curing Technology Study of Superconducting Coil for 230 MeV Proton Cyclotron .....	.....
.....	..... YIN Meng, WANG Chuan, ZHANG Tianjue, ZHANG Suping, ZHANG Xihu, GUO Ruyong, LYU Yinlong, CUI Tao, CHENG Yu(359)
Testing and Improvement Study on Neutron Detection Performance of GdI <sub>3</sub> :Ce Scintillator .....	.....
.....	..... WANG Zhongqing, HUANG Yuefeng, LI Yongping(365)
Study on Performance of a Novel CeBr <sub>3</sub> Scintillator Detector .....	.....
.....	..... ZHOU Qianqian, HOU Yueyun, LIANG Juncheng, ZHANG Chunsheng, WANG Renbo(371)
Effect of Electron Beam Irradiation on Microorganism Inactivation and Quality of Wet Raw Noodle .....	.....
.....	..... SHI Yimo, WANG Li, LI Shurong, ZHANG Chunhong, ZHANG Weidong, XU Yuqian, WANG Huihua, LIU Xiaofei, MA Changlu, PAN Yan, GAO Meixu(378)

**Editors** HOU Cuimei, MA Yingxia, WANG Baojin, WANG Tiaoxia, TANG Xiaohao, ZHANG Xiuping, HAN