

主管单位:中华人民共和国公安部  
主办单位:中国消防协会  
承办单位:公安部天津消防研究所  
中国标准连续出版物号:ISSN 1009-0029  
CN 12-1311/TU  
《中国消防》杂志社  
社长 总编辑:葛明礼  
执行总编辑:张立果  
副社长:李学诚

《消防科学与技术》编辑委员会  
主任:杜兰萍  
副主任:范维澄(院士) 张清林  
委员:(按姓氏笔画为序)  
王中铮 方正 比扬·卡尔森(冰岛)  
东靖飞 孙金华 朱国庆 李引擎  
李国强 李炎锋 吴宗之 宋波  
闵永林 陆守香 赵锂 袁家永  
徐志胜 黄晓家 梁栋 游宏仁(美国)  
蒋军成 董希琳 韩林海

《消防科学与技术》编辑部  
总编辑:张清林(兼)  
主编:王铁强  
副主编:王万钢  
编辑部主任:卿玉军  
责任编辑:刘征 翟兵 董理  
毛星 姜艳娜  
编辑出版:  
《中国消防》杂志社《消防科学与技术》编辑部  
编辑部地址:天津市和平区卫津南路110号  
邮政编码:300038  
编辑部电话:(022)23388612 23990235  
传真:(022)233882744  
投稿邮箱:ffjx@tjxfj.com.cn  
网址:HTTP://WWW.XFKJ.FLJIN.COM.CN  
广告策划:杨群旭 姜艳艳  
广告发行部电话:(022)233887276  
电子邮箱:guangggao@tjxfj.com.cn  
国内发行:《消防科学与技术》编辑部  
国外发行:中国图书出版社有限公司  
国外发行代号:50880M  
印刷:天津环球磁卡股份有限公司  
出版日期:2017年11月15日  
发行范围:国内外公开发行  
定价:30.00元/册 400.00元(含光盘)/全集  
国外定价:15.00美元/册  
准营证:新登记20104400238号

本刊发表全部文章和图片版权均属《消防科学与技术》编辑部所有,如需转载或转摘,请与本刊编辑部联系,未经授权不得以任何形式转载。

中文核心期刊·中国科技核心期刊

# 消防科学与技术<sup>®</sup>

XIAOFANG KEXUE YU JISHU

(月刊·1982年创刊)

2017年第11期(总第36卷第267期)

## 目 次

### 消防理论研究

- 高温后高性能混凝土与钢筋的力学性能与红外检测 ..... 陈良豪、杜红秀、张茂林(1483)  
装配式混凝土梁受火后抗弯承载力可靠度 ..... 蔡斌、李波、张博等(1487)  
TiO<sub>2</sub>/CB-PC复合光催化剂的制备及其降解苯的研究 ..... 郭凤南、史宁、吕佳佳等(1491)  
GC-MS法测定烟气中多环芳烃含量的采样技术 ..... 何瑾、刘军军、郭海东等(1494)  
六种树种枝叶的热解特性及动力学研究 ..... 周润青、苏文静、魏洪珉等(1497)  
可燃气体及混合物爆炸极限影响特征研究 ..... 任常兴、张欣、张琰等(1500)

### 建筑防火设计

- 多方耦合的建筑火灾数值模拟研究及应用 ..... 江列霖、史超、杨培中(1504)  
坡度对疏散影响的试验研究 ..... 汤雪飞、季经纬、谢信亮等(1508)  
新规下养老建筑安全疏散与避难空间设计 ..... 庄凌、郝恩田、李洁等(1512)  
车辆阻塞效应下公路隧道火灾临界风速 ..... 梁华刚、谢冰雪、庞丽琴(1515)  
侧吹风对建筑外立面窗溢流流动的影响 ..... 赵宇航、李俊梅、董启伟(1518)  
基于正交试验分析地铁隧道火灾能见度影响因素 ..... 黄健博(1521)  
火灾下城际铁路隧道温度分布规律研究 ..... 帅卫红(1524)  
含内天井高层住宅火灾烟气流动分析 ..... 梁军、朱国庆(1527)  
防烟空气幕应用于地铁火灾时的模拟研究 ..... 刘志亮(1530)  
消火栓环网中水泵接合器连接点位置探讨 ..... 陈鲲、鲍财胜(1534)

### 灭火系统设计

- 水雾段用于城市隧道阻烟分隔的全尺寸试验 ..... 陈娟娟、田铁峰、方正(1537)  
七氟丙烷灭火剂瓶组安全泄放动作压力 ..... 高云升、刘连喜、胡雪彦等(1540)  
下垂型喷头对防火玻璃隔墙的冷却效果研究 ..... 葛晓霞、尹强(1543)  
洒水喷头密封元件应用探讨 ..... 高振锡、方超、张源雪(1547)

### 消防设备研究

- 基于BLE与RFID的消防设施移动巡检系统 ..... 李森、彭玲、宇林军等(1549)  
疏散通道交叉口诱导标志设计 ..... 刘盛鹏(1552)  
古建筑用火源感温探测器响应温度研究 ..... 田水承、张成镇(1554)  
两种图像火灾探测技术的对比分析 ..... 李惠菁(1557)  
基于WiFi的校园建筑消防系统设计 ..... 王旭东(1560)

### 灭火剂与阻燃材料

- 不同类型压缩空气泡沫灭油池火性能比较 ..... 傅学成、陈涛、胡成等(1563)  
低压环境对AFFF发泡和析液性能影响研究 ..... 伍毅、孙强、张汉飞等(1567)  
添加剂对气溶胶灭火剂性能的影响 ..... 何亚丽、黄寅生、张辉建等(1571)  
改性环氧树脂超薄膨胀型防火涂料 ..... 邵志恒、庄勋港、许一婷等(1574)  
聚丙烯酰胺改性硅灰基阻燃木材涂料 ..... 王若琪、王亚超、杜逸璞等(1578)  
聚氨酯木塑复合材料的协效阻燃抑烟及性能 ..... 丛佳玉、杨国超、张伟等(1581)

### 消防管理研究

- 文物建筑防火评估与日常维护管理 ..... 官钰希、王天然、方正等(1585)  
GIS在石油化工消防应急辅助决策中的应用 ..... 刘福琦、张明广、尤明伟等(1588)  
锂离子电池热解气体释放特性研究 ..... 秦帅星、郭超超(1592)  
锂离子电池性能测试防爆箱的安全性设计 ..... 刘静(1595)  
LS-SVM模型在城市燃气管道风险评估中的应用 ..... 王新颖、宋兴帅、杨泰旺等(1598)

- 埋地热油管道周围温度场计算方法 ..... 王明、段亦骏、彭世垚等(1602)  
油罐火灾中常用战斗服热的防护性能 ..... 张涛、黄卫联、李玉(1606)  
提高虚拟火场临场感的研究 ..... 林灵、朱江、吴疆(1609)  
基于改进SURF算法的双目视觉火灾定位方法 ..... 欧阳继能、卜乐平、王腾等(1613)  
基于Virtools软件的校园消防安全培训系统研发 ..... 胡洁、方书昊、史纬等(1617)  
国内部分耐火电缆在英国标准下的耐火表现 ..... 张秉浩、冯军、唐勇等(1621)  
工业企业火灾成因分析及对策探讨 ..... 孙金杰(1624)  
法定节假日商业综合体人员滞留量研究 ..... 李晓丽、朱国庆(1626)

### 火灾调查与分析

- 无人机在一起疑难火灾调查中的应用 ..... 梁军(1630)  
一起地铁盾构机燃爆事故的调查与思考 ..... 林勇河、叶一帆(1633)

# Fire Science and Technology

(monthly)

Founded in 1982

Vol. 36, No. 11, November 2017

**Unit in charge:** The Ministry of Public Security of the People's Republic of China  
**Sponsor:** China Fire Protection Association

**Undertake:** Tianjin Fire Research Institute of the Ministry of Public Security  
**President(Editor in Chief):** Ge Mingli  
**Executive Editor in Chief:** Zhang Liguo  
**Vice President:** Li Xuecheng  
**Editor in Chief:** Zhang Qinglin  
**Chief Editor:** Wang Tieqiang  
**Assistant Editor:** Wang Wangang  
**Editorial director:** Xing Yujun  
**Editorial Panel:** Liu Zheng, Liang Bing, Dong Li, Mao Xing, Li Yanna

**Publisher and Editor:** Editorial Office of Fire Science and Technology, 110 South Weijin Road, Tianjin 300381, China  
**Tel:** (86-22)23383612/23920225  
**Fax:** (86-22)23387274

**E-mail:** fire@xskj.com.cn

**URL:** http://www.xfkj.com.cn

**Advertisement:** Yang Chunxu, Li Yanyan  
**Advertisement/Distribution Department**

**Tel:** (86-22)23387276

**E-mail:** guanggao@xfkj.com.cn

**Subscription:** Editorial Office of Fire Science and Technology

**Overseas Distributor:** China International Book Trading Corporation(M1508)

**CSSN:** ISSN 1009—0029  
CN 12—1311/TU

**Publishing date:** 2017—11—15

**Price:** ¥30.00

**Oversea Price:** \$ 15.00

## CONTENTS

### Fire theory study

- Rheological properties of unburned deformed high performance concrete estimated based on shiften temperature model ..... CHEN Liang-hao, YU Hongke, MAOQING Maoying(2487)  
Influence of burning reactivity of plain concrete dams on fire steel bar stability ..... CHENG Jia, ZHANG Jun, HUANG Junru(1487)  
Preparation of TiO<sub>2</sub>/CB-PC composite photocatalyst and study on its degradation of Benzene ..... HU Zhen-hai(292)  
Exploration on the fire safety characteristics of super capacitors ..... GAO Feng-nan, SHI Ning, LV Jia-jia, et al.(1491)  
Sampling technique for determination of polycyclic aromatic hydrocarbons in fire-resistant materials ..... GOU Ming-xin, et al.(296)  
Influence on the combustion performance of exterior spray polyurethane foam by Guaibaideng, et al.(1494)  
Pyrolytic characteristics and kinetics research on six common tree species ..... ZHAO Cheng-gang, ZHANG Wei(299)  
Study on combustion behavior of four typical aerosols ..... ZHOU Lihua, HUANG Shuai, SHI Wen-jing, WEI Hong-min, et al.(1497)  
Overview on the characteristics of explosion limits of gases and gas mixtures ..... YANG Liu, WANG Zhi(302)  
Research on change rule of methane explosion limit ..... BEI Changxiang, ZHANG Xintie, ZHANG Yan and others(306)

### Building fire protection design

- Influence of aluminum powder in Kunshan "8·2" accident ..... LIU Xiang, ZHENG Xiang, et al.(301)  
Research and application of multi-field coupled building fire numerical simulation method ..... LI Si-qian, et al.(309)  
Infrared spectrum analysis of combustion products of wire ..... JIANG Lie, ZHENG Jun, ANG Pengzhou(313)  
The experimental studies on influence of slope on evacuation ..... TANG Xue-fei, JI Jing-wei, XIE Xin-liang, et al.(1508)

### Building fire protection design

- Safe operation and design of smoke control system based on the smoke control effect ..... CHEN Ying, CHIZNUWNg Higgi-Qie, Hu Han-chang, et al.(313)  
Numerical calculation study of highway tunnel fires under mobile blockage lateral smoke extraction system ..... YANG Jianqiu, PAN Yong, XIE Wang, GU Zirang, Li-qiong(315)

- Research on the influence of the characteristics of SWOT analysis on fire incident for pension institutions ..... ZHAO Yu-hang, KUANG Xue-dong, DONG Qiang(328)  
Analysis on influencing factors of smoke visibility in underground shopping space based on the orthogonal experiment ..... ZHOU Yumei, LI Li, ZHOU De-huang, Jia-jun(321)

- Standard design of distribution law of indoor longitudinal ventilation mode ..... SHUAI Wei-hong(1524)

- Effect of multi-story hollow space on fire smoke flow in high building ..... GUILING JIHEZHENG Geling(1525)

- Simulation investigation of air seal for survival rooms against a slow station fire ..... ZHAO Xuhui(1529)

- Discussion on the conception and position of public building group by fire protection design ..... CHEN Kang, HAN Caisheng(334)

### Design of fire extinguishing system

- Field test results of water mist cooling system about auto-ignition spreading and flame propagation for oil tank fire ..... LUO Hui, CHENG Jie, NEI YIAN, THENG Feng, ZHENG Zheng(339)  
Design of appropriate water gun range safety of fire pressure water monitoring system ..... XIAO Yan, et al.(1540)

- Study on the cooling effect of pendant sprinkler to fireproof glass partition ..... HEN Hui-xia, WU Qiong(1542)

- Discussion on the application of the dry powder and water spray sprinkler to fire protection system ..... GAO Zhuhui, FANG Chao, ZHANN Nan-nan(1545)

- I nozzle on fire extinguishing performance with grid ceiling ..... WU Hai-yan, SHI Hai-hong(348)

- Mobile patrol system of firefighting facilities based on BLE and RFID ..... LI Sen, PENG Ling, YU Lin-jun, et al.(1549)

- Study of fire equipment** ..... LIU Xue-yan, HUA Zhi-qing, FU Zhi-qing(363)

- Design of fire fighting equipment based on fire protection system ..... WANG Xu-dong(1560)

- Extincting and flame retardant material ..... LI Xiao-bai, ZHANG Chen, ZHANG Xue-jun(359)

- Design of film-forming foaming agent for aqueous film-forming foam in oil tank fire ..... TANG Hua-qing, FU Zhi-qing(363)

- Design of film-forming foaming agent for aqueous film-forming foam in tunnel ..... FU XIAO-Li, HUANG Hui, HU Geng, PEI Pei(1563)

- Effect of low-pressure on the foaming and drainage property of large reservoir ..... ZHOU Ning, YMA CHI-Qing, WANG Yafei, et al.(1565)

- Influence of oil painting technology on extinguishing agents equipment ..... WU Hui, HUANG Xinchang, ZHANG Xuyuan, et al.(1571)

- Modified spray simulation, increased fire retardant quality operated rescue tools ..... SHAO Zhi-heng, ZHANG Xun, ZHENG Xue, CHENG Jing, JIN Wei(1574)

- The performance and function of wood flame retardant coatings of fire shutter ..... WANG Ruo-qi, WANG Ya-zhao, LIU Ji-heng(1587)

- Synergistic flame retardancy and smoke suppression and physical properties of polyurethane/wood composites ..... CONG Jia-yu, YANG Guo-chao, ZHANG Wei, et al.(1581)

- Extinguisher and flame retardant material** ..... CONG Jia-yu, YANG Guo-chao, ZHANG Wei, et al.(1581)

- Fire manage study** ..... JIA Jing-yun, CHEN Xian-tao, SUN Qiang, et al.(383)

- Preparation and property of nitrogen-releasing of cultural relic buildings proof material ..... BO Xue-qian, YU Xian-mei, ZHOU Kang-Zhong, et al.(1585)

- Application of GIS in decision making of petro chemical fire emergency aid ..... LIU Fu-qi, ZHANG Ming-guang, YOU Ming-wei, et al.(1588)

- Blockage of porosity of polyacrylate clay for lithium ion battery ..... QIN Shu-hui, CHENG Jia-hui, YANG Jia-hui(1592)

- Design of explosion-proof leak detection system based on Credal network ..... LIU Jing(1595)

- Application of LS-SVM model in the risk assessment of urban gas pipelines ..... LI Fei, MA Chi-xiang, et al.(1595)

- The application of big data in the pipeline safety ..... WANG Xinying, SONG Xing-shuai, YANG Tai-wang, et al.(1598)

- Calculation method of temperature field of underground heat pipe ..... WANG Qiu-yan, SUN Ping-ping, et al.(1598)

- Analysis of patent information in forest fire home and abroad ..... YOUNG Yue, LIU Wenyi, HENWANG Kai, et al.(1602)

- Rheumatotherapy psychological behavior blanket clothing for firefighters of oil tank fire ..... LIAO Shengjiang(1604)

- Fire investigation and analysis** ..... ZHANG Tao, HUANG Wei-lian, LI Yu(1606)

- Research to improve the feeling of the virtual fire environment ..... LIN Ling, ZHU Jiang, WU Jiang(1609)

- Emergency vision fire location method based on improved SIFT algorithm ..... OUYANG Jia-qing, BUCHANG JIA, WANG Teng, LIN Jing(1673)

- Development of stamp of the safety training records based on collected molten beads of aluminum-wire under different combustion conditions ..... YE Hai-lan, JIANG Nong, HUANG Shu-wei, et al.(1607)

- Performance of flame retardant characteristic and flame retardant based on fire retardant paint thinner ..... ZHANG Ning-hai, WENJUN Fan, ZHANG Yong-zhuan(1621)

- Study and analysis of plastic characteristics of plastic enterprises ..... LUO Siu-hui(1624)

- Study on the heat transfer properties of commercial complex with gypsum board ceiling ..... LI Xue-fu, ZHU Guo-qing(1626)

- Application of unmanned aerial vehicles in a difficult fire investigation case ..... GU Zheming, JIANG Bin(1626)

- Investigation and experience of subway shield machine blast accident ..... LIU Yong-he, YIEN Hua(1626)

### Fire investigation and analysis

- Instruction of a fire accident in private residential building ..... ZHANG Xiao-qin, ZHANG Wen-rong(421)

- The application of unmanned aerial vehicles in a difficult fire investigation case ..... GU Zheming, JIANG Bin(1626)

- Investigation and experience of subway shield machine blast accident ..... LIU Yong-he, YIEN Hua(1626)