Hot Articles

“September | 2019”

Science and Technology

Title: Real time monitoring of the chemistry of hydroxylamine nitrate and iron as surrogates for nuclear materials processing

Author: Esther A. Gallmeier | Katharina M. Gallmeier | Joanna McFarlane | Marissa E. Morales-Rodriguez

Journal: Separation Science and Technology

Volume 54 **Issue:** 12 **Page:** 1985 – 1993

Doi: https://doi.org/10.1080/01496395.2019.1606829

Abstract

The separation of actinides in aqueous solution often involves changes in redox chemistry achieved by reagents such as hydroxylamine nitrate (HAN). Thus, in situ monitoring of the chemistry of HAN in contact with plutonium and neptunium in concentrated nitric acid at 35°C is important for the efficacy of Pu-238 extraction. A spectroscopic method of following the chemistry of HAN in contact with iron (as a simulant for plutonium) was developed, using a quantum cascade laser-attenuated total reflectance (QCL-ATR) system. The mid-infrared (3.67–12.5 μm) was chosen for its ability to distinguish the molecular vibrations of analytes and exclude the background absorption of the concentrated HNO3 matrix. The concentrations of chemical species found in the reaction were drawn from the collected QCL power data using Beer's law after a baseline correction. These data were qualitatively compared to a kinetic rate model based on a simplified reaction mechanism. The QCL-ATR method can help determine the areas of stability of HAN, nitrate/nitrite interactions, and assist process control of actinide separations.

Database

Taylor & Francis Journals

Title: Effects of turbulence-chemistry interactions on auto-ignition and flame structure for n-dodecane spray combustion

Author: Yan Zhang | Hu Wang | Ambrus Both | Likun Ma | Mingfa Yao

Journal: Combustion Theory and Modelling

Volume 54 **Issue:** 12 **Page:** 907 - 934

Doi: https://doi.org/10.1080/13647830.2019.1600722

Abstract

The Engine Combustion Network (ECN) spray A under diesel engine conditions is investigated with a non-adiabatic 5D Flamelet Generated Manifolds (FGM) model with the consideration of detailed chemical kinetic mechanisms. The enthalpy deficit due to droplet vapourisation is considered by employing an additional controlling parameter in the FGM library. In this FGM model, β-PDF is used for the PDF integration over the control variable space. Validation results in non-reacting conditions indicate relatively good agreement between the predicted and experimental data in terms of liquid and vapour penetrations and mixture fraction spatial distribution. In reacting conditions, the effects of variance of mixture fraction and progress variable were examined. The ignition delay time and the quasi-steady flame structure are both affected by the variances. The variance of mixture fraction delays the ignition process and the variance of progress variable accelerates it. For mixture fraction, the ignition process is quicker at any stage in the case of neglecting variance. While things are more complex for progress variable, the ignition process is advanced in the case of neglecting variance at early times, but surpassed by the case of β-PDF later and until auto-ignition. When variance of mixture fraction is considered, the OH mass fraction shows a wide spatial distribution. While if not, a very thin flame is observed with a higher peak in OH, and a very large lift-off length. The variance of progress variable has little impact on the global flame structure, but makes the flame lift-off length much shorter. This study confirms the general observation, that the variance of mixture fraction is of higher importance in high temperature non-premixed combustion, however, we found that the variance of progress variable is far from negligible.

Database

Taylor & Francis Journals

[Science and Technology]

Title: Prototype development of responsive kinetic façade control system for the elderly based on Ambient Assisted Living

Author: Sungil Ham | Heayon Cho | Hyunsoo Lee | Ghang Lee

Journal: Architectural Science Review

Volume 62 **Issue:** 4 **Page:** 273 - 285

Doi: https://doi.org/10.1080/00038628.2019.1614902

Abstract

The elderly suffer from discomfort in social life owing to the decline of their physical, psychological, and social functions. The elderly who spend a lot of time indoors require an intelligent system to extend their time to live independently in a residential environment. Recently, the Ambient Assisted Living (AAL) concept was introduced to commercialize various technologies and apply them to urban and architectural environments. However, AAL's connection to architectural elements is insufficient. This study intends to build a residential environment platform that integrates Internet of Things (IoT) technology and architectural elements to support the independence of the elderly based on the AAL concept. The proposed platform is designed to be applied to various scenarios and services. A responsive façade system was designed to verify the platform, and the usefulness of the system was evaluated through the interaction of the designed façade and an acting manager.

Database

Taylor & Francis Journals

[Science and Technology]

Title: Season Effects on Subsurface Constructed Wetlands Performance: Role of Radial Oxygen Loss of Phragmites australis

Author: Qian Wang | Zhenfeng Cao | Yanbiao Hu | Qiang Kong | Fei Xu | Yuanda Du | Congcong Zhao

Journal: CLEAN Soil Air Water

Volume 47 **Issue:** 8 **Page:** -

Doi: https://doi.org/10.1002/clen.201800428

Abstract

Radial oxygen loss (ROL) in plants plays an important role in the oxygen supply of subsurface-flow constructed wetlands (SSF CWs). In this research, two types of microcosm, Phragmites australis-planted wetlands (PA) and unplanted wetlands as the control (CT), are set up to investigate seasonal variations in ROL and their effects on pollutant removal. The chemical oxygen demand (COD) and NH4+-N removal efficiency are detected, and the oxygen contributions produced by ROL are calculated for different seasons. The results show that the removal efficiency differences between PA and CT are significant in autumn and winter. The oxygen obtained from ROL is considerable in spring (120.12 ± 8.85% mg m−3 per day) and summer (1663.3 ± 36.4% mg m−3 per day), followed by autumn (494.32 ± 60.7% mg m−3 per day) and winter (27.95 ± 9.84% mg m−3 per day) and is positively correlated with the removal efficiency of COD ($r = 0.786$, $p < 0.01$) and NH4+-N ($r = 0.758$, $p < 0.01$). Investigations of plant growth and physiological indexes showed that ROL is positively correlated with dry weight (DW), net photosynthetic rate (Pn), stomatal conductance (Gs), and especially root porosity ($r = 0.731$, $p < 0.01$) and negatively correlated with plant height. These results indicate that the oxygen produced by ROL in CWs is considerable throughout the year, even in winter, and that root porosity has an important impact on seasonal variation in ROL.

Database

Wiley Online Library

[Science and Technology]

Title: A Comparative Analysis of Anthropogenic CO2 Emissions at City Level Using OCO-2 Observations: A Global Perspective

Author: Peng Fu | Yanhua Xie | Caitlin E. Moore | Soe W. Myint | Carl J. Bernacchi

Journal: Earth's Future

Doi: https://doi.org/10.1029/2019EF001282

Abstract

Satellite observations of anthropogenic carbon dioxide (CO_2) emissions within urban settings offer unique potential to understand carbon sources and sinks and evaluate carbon mitigation strategies. Despite availability of column-averaged dry air mole fraction of CO_2 (X_{CO_2}) from Orbiting Carbon Observatory-2 (OCO-2), temporal variations of X_{CO_2} and their drivers in cities remain poorly understood due to inconsistent definitions of urban extent, diverse urban forms, and unresolved impacts of urban vegetation on carbon fluxes. To this end, this study revealed that OCO-2 X_{CO_2} measurements from 2014 to 2018 exhibited statistically significant seasonal and trend components for each city. A correlation analysis suggested a weak association between X_{CO_2} trends and fossil fuel CO_2 emissions (FF_{CO_2}) trends but a close relationship between yearly average X_{CO_2} and FF_{CO_2} trends. Vegetation abundance exhibited a negative relationship with the X_{CO_2} seasonality, though it only explained 21% of the variance. No statistically significant relationship between urban morphological factors (areal extent, complexity, and compactness) and temporal X_{CO_2} components was observed. However, urban morphological factors had a close relationship with the total amount of FF_{CO_2} aggregated over the study period. Thus, it was speculated that urban morphological factors exerted their influence on X_{CO_2} through fossil fuel consumption. When only cities of high normalized difference vegetation index seasonality were used, statistically significant correlation coefficients between urban morphological factors and winter/summer averaged X_{CO_2} measurements were found. The variations of these correlation coefficients between leaf-on and leaf-off seasons stress the important role that urban trees play in mitigating carbon emissions in cities.

Database

Wiley Online Library

[Science and Technology]

Title: Binocular high dynamic range imaging system based on digital micromirror device

Author: Honghai Sun | Yanjie Wang | Hang Yang | Pei Wu

Journal: Optical and Quantum Electronics

Doi: https://doi.org/10.1007/s11082-019-2014-6

Abstract

In the applications of scientific imaging and space exploration, the dynamic range of imaging systems is usually required to reach more than 120 dB. In order to observe a highly dynamic scene in real time, we designed an imaging system based on a digital micromirror device (DMD) that is used as a spatial light modulator. First, we designed a binocular highly dynamic light-adjusting system based on a DMD according to the DMD's optical structure. Second, in order to realize the registration between the micromirrors of a DMD and pixels of the two cameras, a pixel-matching algorithm was developed. Finally, we introduce a novel light-adjusting algorithm that can recover the highly dynamic data of the dynamic scene. Experiments showed that the deviation between the DMD and the two cameras is reduced to 0.48 pixels after correction, and that bright and dark targets in a high-dynamic-range scene can both be displayed simultaneously in one image with high quality after light adjustment. The dynamic range of the system is theoretically 209 dB, which meets the requirements of high-dynamic-range observation

Database

SpringerLink

[Science and Technology]

Title: Decadal variations of the North Pacific Tropical Water at 137°E

Author: Wenqiang LinFangguo ZhaiYanzhen GuEmail authorPeiliang Li

Journal: Journal of Oceanology and Limnology

Volume 37 **Issue:** 5 **Page:** 1495 - 1509

Doi: https://doi.org/10.1007/s00343-019-8123-z

Abstract

The decadal variations of the North Pacific Tropical Water (NPTW) at 137°E in the western North Pacific Ocean are investigated based on the repeated hydrographic observations along with two global gridded ocean products. The results indicate that the maximum salinity of NPTW experiences significant quasi-decadal variations, having maxima around 1979, 1987, 1995, 2004, and 2012, while minima around 1974, 1983, 1991, 1999, and 2008 during the period of interest. The NPTW area also shows similar quasi-decadal variation, expanding/shrinking as its maximum salinity increases/decreases at the 137°E section. These variations are induced mainly by changes in the mixed layer salinity in the source region and large-scale circulation in the northwestern tropical Pacific Ocean, both of which are related to the Pacific Decadal Oscillation. The underlying processes at work are further confirmed through conducting the subsurface salinity budget analysis. Besides, short-term processes are also at work through nonlinear interactions, especially after 2000.

Database

SpringerLink

Title: Production of Antibacterial Coatings Through Atmospheric Pressure Plasma: a Promising Alternative for Combatting Biofilms in the Food Industry

Author: Rodolfo Múgica-Vidal | Elisa Sainz-García | Avelino Álvarez-Ordóñez | Miguel Prieto | Montserrat González-Raurich | Mercedes López | María López | Beatriz Rojo-Bezares | Yolanda Sáenz | Fernando Alba-Elías

Journal: Food and Bioprocess Technology

Volume 12 **Issue:** 8 **Page:** 1251 - 1263

Doi: https://doi.org/10.1007/s11947-019-02293-z

Abstract

One of the main problems in the food industry is the formation of biofilms on food contact surfaces. These bacterial communities show high resistance against the commonly used disinfectants, which makes them difficult to eradicate causing economic losses and threatening the quality of the products and the health of consumers. Several studies have reported the use of atmospheric pressure plasma technologies to provide antibacterial properties to a wide range of materials through the deposition of coatings that either avoid the initial attachment of bacteria to the surface or kill the attached bacteria before the mature biofilm is formed. These technologies avoid the use of extreme pressures and temperatures during the deposition process, thus preserving the properties of the substrate, which makes them interesting for their potential application in the production of anti-biofilm food contact materials. This paper reviews different approaches that use atmospheric pressure plasma technologies to combat bacterial colonization and biofilm formation on materials of relevance for the food industry. Three types of approaches are identified and their suitability in the food industry is discussed.

Database

SpringerLink

[Science and Technology]

Title: Security situation assessment for massive MIMO systems for 5G communications

Author: Shiqi Yang | Di Yin | Xia Song | Xiaoming Dong | Gunasekaran Manogaran | George Mastorakis | Constandinos X. Mavromoustakis | Jordi MongayBatalla

Journal: Future Generation Computer Systems

Volume 98 **Issue:** - **Page:** 25 - 34

Doi: https://doi.org/10.1016/j.future.2019.03.036

Abstract

MIMO technology is a key technology of 5G, which is widely used in next-generation scenarios such as heterogeneous networks, millimeter-wave networks, and automotive networks. How to build a large-scale MIMO system security situation assessment model for 5G has become the main topic of current concern. This paper analyzes the situational awareness theory of 5g-oriented MIMO system security. Firstly, based on the theory of MIMO system, the influence of MIMO system on 5G network security and the theory of situation awareness technology, the security situation awareness system model of 5g-oriented large-scale MIMO system is constructed. In the security situation assessment section of the MIMO system, according to the rules of evidence reasoning, of different active attack and passive eavesdropping two kinds of empowerment behavior under different attribute data, and then put the empowerment process of average power and large scale attenuation coefficient, interrupt probability, series, and maintain confidentiality gain data as model inputs, such as implementing MIMO system level of situation assessment. In the security situation prediction part of MIMO system, based on the actual situation level of the system as the criterion, 30 sets of experimental simulation data are used to predict the next moment situation level of the MIMO system. In order to verify the stability and validity of the model, MATLAB is used to simulate the experiment. The results show that the mean square error RMSE of different iterations is kept below 0.02, and the TSQ values of both sides are kept below 0.16. The overall prediction effect of the model was good, indicating that the system could provide effective decision support for 5G MIMO security situation prediction

Database

ScienceDirect

[Science and Technology]

Title: Ozone disinfection of chlorine-resistant bacteria in drinking water

Author: Wanqing Ding | Wenbiao Jin | Song Cao | Xu Zhou | Changping Wang | Qijun Jiang | Hui Huang | Renjie Tu | Song-Fang Han | Qilin Wang

Journal: Water Research

Volume 160 **Issue:** - **Page:** 339 - 349

Doi: https://doi.org/10.1016/j.watres.2019.05.014

Abstract

The wide application of chlorine disinfectant for drinking water treatment has led to the appearance of chlorine-resistant bacteria, which pose a severe threat to public health. This study was performed to explore the physiological-biochemical characteristics and environmental influence (pH, temperature, and turbidity) of seven strains of chlorine-resistant bacteria isolated from drinking water. Ozone disinfection was used to investigate the inactivation effect of bacteria and spores. The DNA concentration and cell surface structure variations of typical chlorine-resistant spores (Bacillus cereus spores) were also analysed by real-time qPCR, flow cytometry, and scanning electron microscopy to determine their inactivation mechanisms. The ozone resistance of bacteria (Aeromonas jandaei < Vogesella perlucida < Pelomonas < Bacillus cereus < Aeromonas sobria) was lower than that of spores (Bacillus alvei < Lysinibacillus fusiformis < Bacillus cereus) at an ozone concentration of 1.5 mg/L. More than 99.9% of Bacillus cereus spores were inactivated by increasing ozone concentration and treatment duration. Moreover, the DNA content of Bacillus cereus spores decreased sharply, but approximately 1/4 of the target genes remained. The spore structure exhibited shrinkage and folding after ozone treatment. Both cell structures and gene fragments were damaged by ozone disinfection. These results showed that ozone disinfection is a promising method for inactivating chlorine-resistant bacteria and spores in drinking water.

Database

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