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2022 6th International Conference of
Energy, Environment and Resources

2022 6th International Conference of
Civil and Environmental Engineering

May 29, 2022
Virtual Conference

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Introduction

2022 6th International Conference on Energy, Environment and Resources (ICEER2022) and 2022 6th International Conference on Civil and Environmental Engineering (ICCEE2022) are organized by Shanghai Laixi Conference Services Co., Ltd. According to the similarity among the topics of ICEER2022 and ICCEE2022, ICEER2022 is held in conjunction with ICCEE2022 virtually on May 29, 2022.

ICEER2022 and ICCEE2022 serve as an optimal platform for specialists, scholars and researchers in the field related to Energy, Environment and Resources, Civil and Environmental Engineering to facilitate academic communications and exchange ideas. The conferences offer an academic space known for its interdisciplinary approach as well as a space for academics and practitioners.

Major themes of the Conferences included:

Energy: Energy Technology, Energy Systems, Clean and Renewable Energy, Biofuels, Biomass and Bioenergy, Advanced Energy Technologies, New Energy Technology, New Energy Applications, Renewable Energy, Integrated Energy Systems, etc.

Environment: Environmental Protection, Health and the Environment, Environmental Economics, Environmental Science and Technology, Environmental Nanotechnology, Environmental Biology, Environmental Engineering, Environmental Engineering & Management, Environmental Chemistry, Environmental Microbiology, etc.

Resources: Renewable Resources, Biotic Resources, Resource Distribution, Resource Management, Water Resources Management, Resource Economy and Management, Resources Development, Resource Exploration, Resource Exploration Engineering, Resource Science and Engineering, etc.

Civil Engineering: Civil Engineering, Civil Engineering Practice, Adapting Civil Engineering Practice, Civil Engineering Planning, Civil Engineering Contracts, Civil Engineering Construction, Infrastructure Projects, Transport Systems and Water Supply Networks, Consultant of Civil Engineering Works, Construction Management and Analysis, etc.

Environment: Environmental Protection, Health and the Environment, Environmental Economics, Environmental Science and Technology, Environmental Nanotechnology, Environmental Biology, Environmental Engineering, Environmental Engineering & Management, Environmental Chemistry, Environmental Microbiology, etc.

The abstracts that were selected had a complete peer review process. Selected papers are also published at the cooperating journals of each conference. They show the richness in interdisciplinary approaches, theories, models and applied research presented in the conference.

We would like to thank you for your scientific contribution to ICEER2022 and ICCEE2022 and look forward to having the opportunity to showcase and disseminate your research.

Special thanks also to the organizing committee, and all the people that worked hard, to bring in light this considerable event.

Sincerely,

ICEER2022 and ICCEE2022 Organizing Committees

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Experimental Study on the Features of Overland Flow and Sediment Effected by Herbaceous Vegetation Coverage

Sun Yi[1], Gu Zhigang[1], Yi Xiaoyan[1], Ma Jing[1], Zhang Xu[2]

[1]Yellow River Inst. of Hydraulic Research YRCC, Zhengzhou, China

[2]Shenzhen Water Planning & Designing Inst. Co., LTD, Shenzhen, China

Email address:

Sunyi031@163.com (Sun Yi), 1041375286@qq.com (Gu Zhigang), 15157250@qq.com (Yi Xiaoyan), 276201614@qq.com (Ma Jing), 1092591761@qq.com (Zhang Xu)

Abstract: Vegetation plays a very important role in runoff and sediment yielding on slope. Vegetation coverage is an important index to indicate the influence of vegetation on slope surface. In order to clarify the effect of vegetation coverage on the velocity and sediment yield, two sets of overland flow experiments are carried out separately on the laboratory flume and on the field slope which are artificially planting an herbaceous of alfalfa at the location of the loess plateau in Qingyang, Gansu Province. The flume experiments are set under the conditions of different vegetation coverage every 15% from 0 to 75% which of the field experiments are every 20% from 0 to 100%. Both two sets of experiments have the same 5 flow discharge from 0.14 L s^{-1} to 1.1 L s^{-1} which are 60 groups in total. It is indicating from the results that: the increase of the vegetation coverage leads to the decrease of velocity. The larger the flow discharge, the greater the effect of vegetation on increasing the slop surface resistance. The sediment yield decreases while the vegetation coverage is increasing. Compared to the slope with no vegetation, the velocity and sediment yield can be reduced by 20% and 50% respectively when the coverage is greater than 20% and can be reduced by 40% and 95% respectively when the coverage reaches 100%. There is a same vegetation coverage threshold of 60%, before which both velocity and sediment yield decreases fast and after which both decreases slowly. The results can provide some theoretical support for soil and water conservation in the loess plateau.

Keywords: Overland Flow, Vegetation Coverage, Velocity, Sediment Yield, Threshold

Solvent-induced Lengthened Conjugated Chains in Electrochromic PEDOT for Enhanced Optical Modulation

Biying Zhuang[1], Xueqing Wang[1], Fengshi Li[2], Qianqian Zhang[1, *], Jingbing Liu[1], Yuying Sun[3, *], Hewei Zhao[2], Hao Wang[1, *]

[1]Key Laboratory for New Functional Materials of Ministry of Education, Faculty of Materials and Manufacturing, Beijing University of Technology, Beijing, China

[2]Key Laboratory of Bio-Inspired Smart Interfacial Science and Technology of Ministry of Education, School of Chemistry, Beihang University, Beijing, China

[3]Beijing Key Laboratory of Green Built Environment and Energy Efficient Technology, Department of Building Environment and Facility Engineering, College of Architecture and Civil Engineering, Beijing University of Technology, Beijing, China

Email address:

zhangqianqian@bjut.edu.cn (Qianqian Zhang), sunyuying126@126.com (Yuying Sun), haowang@bjut.edu.cn (Hao Wang)

Abstract: Conjugated PEDOT is considered as a promising electrochromic (EC) material, while the unsatisfactory optical modulation contrast limits its applications. Enhancing the conjugated chain length has been proved to improve the EC performance of conjugated conductive polymers (CPs). Herein, a simple and effective solvent-induced approach is developed to prepare EC PEDOT with extended conjugated chains. A strong polarity solvent of acetonitrile is employed to electrochemically polymerize PEDOT on a well-designed $Ni(OH)_2$ nanosheet arrays substrate, which facilitates a longer conjugated chain formed in the PEDOT molecules. Compared with the samples obtained in water, the acetonitrile-assistant prepared PEDOT demonstrates a superior EC behavior, including enhanced transmittance contrast (~48% at 550 nm), fast response for coloring/bleaching (1.35 s/0.83 s), ultrahigh coloration efficiency (293.6 cm^2 C^{-1}) and improved cycling durability. The enhanced EC performance improved by long conjugated structure was further explained by the calculations of energy levels and electron transition abilities of the two conjugated PEDOT systems. Finally, a longer conjugated chain of PEDOT obtained in acetonitrile was confirmed by the calculation based on quantum chemistry theory for the first time. Particularly, a stable optical modulation could be maintained in a wide temperature range (-10 to 100 ℃) and harsh acidity environment. This work is anticipated to provide a novel and simple approach to lengthen the conjugated chains of EC PEDOT toward enhanced optical modulation and can also be applicable to various conjugated CPs.

Keywords: Electrochromism, PEDOT, Conjugate Chain Length, Optical Modulation, Energy Storage

Forecasting Factors of the Northward Sharp Turn of Typhoons That Make Landfall

Lina Zheng[1], Zihan Zhang[2]

[1]Jinan Meteorological Bureau, Jinan, China

[2]Dongying Meteorological Bureau, Dongying, China

Email address:

jnzln0103@163.com (Lina Zheng), zhangzihan1114@126.com (Zihan Zhang)

Abstract: A tropical cyclone is a strong cyclonic vortex with a warm central structure occurring on the tropical ocean. It is always accompanied by strong winds and torrential rain. This tropical cyclone is called typhoon in China and East Asia. A typhoon that make landfall can bring great damage to China's eastern coastal provinces. The typhoon path determines the distribution of wind and rain carried by typhoon, so improving the forecast accuracy of typhoon path is always the focus of our meteorological department and scientific research department. In recent years, meteorologists have done a lot of research work on typhoon path, and achieved a lot of results, but the formation mechanism of typhoons that sharp turn is still not clear. In order to improve the forecast ability of typhoon path, this paper uses band-pass filter approach and balance principle of three forces (pressure gradient-force, typhonic internal force and coriolis force) in synoptics to analyze the key forecasting factors of typhoon's sharp turn by taking typhoon YAJI and RUMBIA as examples, which made landfall and affected Shandong province in 2018. The results show that the typhoon track largely depends on the location and intensity of the subtropical high (continental high). The typhoon direction can be predicted using the principle of three forces balance when the subtropical high is more significant. Meanwhile, the wind direction of the 300~200 hPa level can be used to predict the change of typhoon direction 18 hours in advance. The sharp turn of typhoon YAJI at 08: 00 on August 15 is due to the influence of high-frequency airflow and its movement along the positive high- frequency vorticity advection. The full wind speed and low-frequency airflow lead typhoon RUMBIA turn to the northeastward when it enters Bohai Sea. It can be concluded that high-frequency advection favors the sharp turn of typhoon direction, while the environmental wind field influences the typhoon with subtle change in direction.

Keywords: Typhoon, Landing and Moving Northward, High-frequency Airflow, Low-frequency Airflow

Acknowledgements

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Temporal Variation Characteristics of $PM_{2.5}$ in the Beijing-Tianjin-Hebei Region, China, from 2014-2021

Lili Wang[1], Gaofeng Wu[2], Xinyu Wang[1], Wenji Zhao[1, *]

[1]College of Resource Environment and Tourism, Capital Normal University, Beijing, China

[2]Beijing Aodaqing Environmental Detection Co., Ltd., Beijing, China

Email address:

wll_0423@163.com (Lili Wang), wgf_0307@163.com (Gaofeng Wu), wxywxyeah@163.com (Xinyu Wang), 4973@cnu.edu.cn (Wenji Zhao)

Abstract: Particulate matter ($PM_{2.5}$) pollution is extremely harmful to the environment as well as human health. The Beijing-Tian-Hebei (BTH) region is one of the megacity clusters with severe $PM_{2.5}$ pollution across the country. The Chinese government has formulated a series of air pollution prevention and control measures (*the Air pollution Prevention and Control Action Plan for Atmospheric Pollution* and *Three-year Action Plan for the Defense of the Blue Sky* etc.). To fully understand temporal variation characteristics of $PM_{2.5}$ in the BTH region after the implementation of the air pollution control policy, a eight-year time series (from January 2014 to December 2021) of $PM_{2.5}$ concentration data from 118 air quality monitoring stations were studied. The results showed that the average annual $PM_{2.5}$ concentration in the BTH region were 94.8 (2014), 77.1 (2015), 69.9 (2016), 64.9 (2017), 55.6 (2018), 48.8 (2019), 44.2 (2020) and 38.4 μg/m^3 (2021), respectively. The average annual $PM_{2.5}$ concentration in the BTH region decreased from 94.8μg/m^3 (2014) to 38.4 μg/m^3 (2021), with a decrease of 59.5% in the eight-year period. The $PM_{2.5}$ pollution showed a more significant change with the highest $PM_{2.5}$ concentration in winter and the lowest in summer. The monthly average $PM_{2.5}$ pollution in the BTH region from 2014 to 2018 showed a U-shaped pattern, which declined from January to June, and increased from August to December. The $PM_{2.5}$ pollution from May to September was low. Days in which $PM_{2.5}$ concentration was below the 24-hours average grade I standard (35μg/m^3) of *China's Air Quality Standards (GB 3095-2012)* increased year by year. The days when $PM_{2.5}$ concentration was less than 35μg/m^3 in Beijing, Tianjin and Hebei increased from 22.7%, 13.1% and 7.3% in 2014 to 71.1%, 58.8% and 56.6% in 2021, respectively. The proportion of days exceeding 100 μg/m^3 in Beijing, Tianjin and Hebei less than 15% after 2017. The number of cities whose $PM_{2.5}$ concentration reached the annual average grade II standard (35μg/m^3) of *China's Air Quality Standards (GB 3095-2012)* is gradually increased. No cities met the standard in 2014, while in 2021, the average $PM_{2.5}$ concentration of three cities (Chengde, Qinhuangdao and Zhangjiakou) met the standard. Overall, China has achieved its *Air Pollution Prevention and Control Plan* goal of reducing the $PM_{2.5}$ concentration in the BTH region by 25% by 2017. The prevention and control of $PM_{2.5}$ pollution in the BTH region has achieved remarkable results.

Keywords: $PM_{2.5}$, Air Pollution, BTH Region

Heavy Metal Pollution and Potential Ecological Risk of Reclaimed Land in the Southeast of Beijing

Fei Gao[1], Gaofeng Wu[2, 3, *], Huiting Wu[2, 3]

[1]Beijing Soil and Fertilizer Extension Service Station, Beijing, China

[2]China Testing & Certification International Group Co., Ltd., Beijing, China

[3]Beijing Aodaqing Environmental Detection Co., Ltd., Beijing, China

Email address:

wgf_0307@163.com (Gaofeng Wu)

Abstract: Heavy metals in the soil of agricultural areas will cause damage to the ecological environment and ultimately endanger human health. To fully understand the environmental pollution of heavy metals in the reclaimed land in the southeast agricultural area of Beijing, 718 topsoil samples (0~20 cm) were collected in the rehabilitation area in the southeast of Beijing. The physical and chemical properties of eight heavy metals (Cd, Hg, As, Pb, Cr, Cu, Ni and Zn) in the topsoil of reclaimed land were measured. Based on the Nemerow comprehensive pollution index and potential ecological risk assessment method, the pollution characteristics and potential ecological risk of eight heavy metals were statistically analyzed. At the same time, the sources of heavy metals were briefly discussed by correlation coefficient and principal component analysis. The results show that the soil pH of reclaimed land ranged from 7.14 to 8.87, and the average organic matter was 15.1 g/kg. From the single potential ecological pollution index of each heavy metal, 95.1% of the topsoil samples of reclaimed land have one or more heavy metals that exceed the corresponding background value of soil heavy metals in Beijing. Among them, the pollution proportion of Cd and Ni is relatively high, and the over standard rates are 77.6% and 56.3% respectively, showing slight pollution. The over standard rates of Hg, Cu and Cr are similar, all about 25%. Zn, As and Pb do not exceed the standard. The average value of individual ecological risk index (E_r^i) from greatest to least are Cd (39.16) > Hg (36.28) > As (6.46) > Ni (5.21) > Cu (4.53) > Pb (1.92) > Cr (1.72) > Zn (0.77). Cd and Hg indicate low ecological risk. As, Ni, Cu, Pb, Cr and Zn indicate minor ecological risk. The average value of comprehensive ecological risk index (*RI*) in the study area is 96.05, which indicates low ecological risk. The comprehensive pollution index showed that the reclaimed soil was slightly polluted as a whole (the average P_N was 1.20). The results of source analysis showed that the sources of the eight heavy metals were mainly related to long-term sewage irrigation, the use of agricultural fertilizers and pesticides, atmospheric deposition and their natural sources.

Keywords: Ecological Risk Evaluation, Environmental Pollutant, Reclaimed Land, Beijing

Sulfate-functionalized Core-shell ZnO/CdS/Ag_2S Nanorod Arrays with a Gradient Energy Band Configuration for Photoelectrochemical Water Splitting

Xiaoyu Xie*, Chunxiang Xu, Zhiyong Li

State Key Laboratory of Bioelectronics, School of Biological Sciences & Medical Engineering, Southeast University, Nanjing, China

Email address:
230189584@seu.edu.cn (Xiaoyu Xie), xcxseu@seu.edu.cn (Chunxiang Xu), 987553534@qq.com (Zhiyong Li)

Abstract: Insufficient light absorption and fast charge recombination seriously restrain the photoelectrochemical (PEC) water splitting performance of semiconductor photoelectrodes. Herein, sulfate ([SO_4]) functionalized CdS was decorated on ZnO nanorod arrays by one-step magnetron sputtering to construct a core-shell heterojunction, and then Ag_2S nanoparticles were deposited by cation exchange. The in-situ formed [SO_4] as an active site is helpful to accelerate charge transfer and enhance PEC reaction kinetics. Additionally, Ag_2S was modified on ZnO/CdS to suppress the photocorrosion of CdS while constructing two heterojunctions with a gradient energy band configuration for separating and transporting photogenerated charge carriers efficiently. Benefiting from the dual-charge-transfer channels in [SO_4] and Ag_2S co-modified ZnO/CdS nanorod arrays, the optimized photoanode presents high PEC performance, yielding a maximum photocurrent density of ~6.82 mA cm^{-2} at 1.23 V vs. reversible hydrogen electrode (RHE) under simulated air mass (AM) 1.5 solar light illumination, which is 7.75 times that of pristine ZnO photoanode. This work provides a synergetic in-situ [SO_4] modification and heterojunction construction strategy to design photoelectrodes with multicharge-transfer channels for enhanced PEC performance.

Keywords: Core-shell, [SO_4] Functionalized CdS, Dual-charge-transfer Channels, ZnO/CdS/Ag_2S Nanorod Arrays, Photoelectrochemical Water Splitting

Flexible PVDF-based Photocatalyst with Piezoelectric Effect for Enhanced Degradation of Organic Pollutants

Ru Wang*, Chunxiang Xu, Mingliang Wang

State Key Laboratory of Bioelectronics, School of Chemistry and Chemical Engineering, Southeast University, Nanjing, China

Email address:
1049043688@qq.com (Ru Wang), xcxseu@seu.edu.cn (Chunxiang Xu), wangmlchem@seu.edu.cn (Mingliang Wang)

Abstract: Piezoelectric field engineering has been recently proved to restrain the photogenerated carrier recombination both in the bulk and on the surface of photocatalyst. Herein, we proposed a bi-piezoelectric ZnO/PVDF-HFP spongy film that can utilize water flow vibration to boost the photocatalytic degradation of organic dye and crude oil. The composite photocatalyst can be deformed by water flow to generate an integrated piezoelectric field from PVDF-HFP and ZnO, which can considerably drive the separation and transfer of photogenerated charge carriers in ZnO. As a result, the ZnO/PVDF-HFP spongy film shows a ~3 fold increase in reaction rate constant of degrading methyl orange (MO) with irradiation as flow speed increases from 200 rpm to 1000 rpm. Remarkably, this hybrid film displays a high efficiency of 14.18% on decomposing crude oil (~20 mg) after irradiation for 6 hours with 1000 rpm stirring. A model about the bi-piezoelectric effect of ZnO/PVDF-HFP was configurated according to a series of characterization by piezoelectric force microscopy (PFM) and photoluminescence (PL). This work demonstrates the contribution of bi-piezoelectric effect to photocatalytic water decontamination and provides a promising strategy to use dual-sustainable energy— solar and water energy.

Keywords: Bi-piezoelectric Effect, Water Flow Vibration, Integrated Piezoelectric Field, Decomposing Crude Oil, Dual-sustainable Energy

Activation of Peroxymonosulfate (PMS) by Core-shell $ZnO@Co_3O_4$ for the Degradation of Tetracycline (TCs)

Zhou Hao[1], Huang Mei[1, 2, *]

[1]College of Chemical & Biochemical Engineering, Zhejiang University, Hangzhou, China

[2]Institute of Zhejiang University, Quzhou, China

Email address:

996098120@qq.com (Zhou Hao), huangm@zju.edu.cn (Huang Mei)

Abstract: The abuse of tetracycline (TCs) causes persistent environmental pollution, and its efficient degradation and source reduction are of great significance. In this work, the core-shell $ZnO@Co_3O_4$ was synthesized by using metal-organic framework material (MOFs) as precursor via two-step synthesis method, which was further used as the catalyst for the oxidative degradation of TCs in the presence of potassium peroxymonosulfate (PMS). A variety of microscopic characterizations (SEM, XRD, XPS, EDS) were used to observe the microstructure and morphology of the as-prepared samples. The effects of Co/Zn ratio, organic ligand content and calcination temperature on activation of (PMS) were investigated to obtain the optimum preparation conditions. Experimental results show that the removal rate of COD and conversion rate of TCs can reach 70% and 100%, respectively, with 0.1g/L $ZnO@Co_3O_4$ and 1.8g/L PMS in 50mg/L TCs solution. $ZnO@Co_3O_4$ maintained high catalytic activity after continuous degradation of TCs, indicating its high catalytic activity and good cycle stability. EPR Experiments discuss the main active species for the degradation of TCs in the catalytic oxidation system. This work gives a deep insight into the removal of antibiotics in polluted water.

Keywords: $ZnO@Co_3O_4$, Core-shell, MOFs, PMS, Degradation

The Exploration of the Unusual Prevalence of Residential Buildings in Sichuan's Rural Regions: The Unwillingness to Adopt Timber Structure

Zhenquan Zhou[1, 2], Deprizon Syamsunur[2, *], Xinyi Wang[1]

[1]School of Architecture and Engineering, Tianfu College of SWUFE, Mianyang, China

[2]Department of Civil Engineering, Faculty of Engineering, Technology and Built Environment, UCSI University, Kuala Lumpur, Malaysia

Email address:

zhouzhenquan@tfswufe.edu.cn (Zhenquan Zhou), deprizon@ucsiuniversity.edu.my (D. Syamsunur),
wangxinyi@tfswufe.edu.cn (Xinyi Wang)

Abstract: Timbers are considered suitable building materials for resisting significant earthquakes, while brick-concrete types have relatively poor anti-seismic performance facing this natural disaster. Through efficient energy dissipation, timber materials can effectively protect the integrity of bearing structures under a significant external force. Thus, the Sichuan province of China, a typical earthquake region, can utilize this flexible building material for rural residences. Besides, Sichuan has recently had an increasing number of wooden resources, lowering timber construction costs. However, fewer rural buildings still use timber structures, and stakeholders are more willing to erect brick-concrete residences than wooden constructions. This unreasonable construction preference is not strictly under the Sustainable Development Goals presented by the United Nations, which may prevent the sustainable development of Sichuan's construction intangibly. Accordingly, it is essential to explore the reasons for causing this prevalence of local construction, trying to figure out how residents can accept timber buildings. This research plans to double-check the current situation of rural construction preference in Sichuan by employing approaches of the site investigations and using questionnaire surveys. This research considers technical maturity, the acceptance level of wooden constructions and economic reasons that most rural residents in Sichuan are willing to select brick-concrete types rather than timber residences. Secondly, the acceptance level influencing construction selection is analyzed by interviewing Sichuan's local industry professionals and scholars. Then, formal questionnaires will determine the primary drivers for causing the resistance to adopting wooden types. Additionally, desk research could determine if the economic considerations influence the local construction preference. The anticipated outcome of this research is to determine the critical factors causing the unreasonable prevalence of brick-concrete residences in Sichuan's rural region. Specifically, the maturity of construction codes and technical suggestions may be the relatively important causes. The quantitative and qualitative methods can assist in figuring out the causes so that practical solutions can be formed to change the current preference. If timber structures can replace brick-concrete types for rural residences in Sichuan, this change can significantly improve the local sustainability, including safety, economy and other intangible aspects. Besides, this research can be a typical example for other similar seismic regions in China pursuing sustainable development via the construction industry. Moreover, the research results can also enrich the knowledge area of stakeholder management in Chinese engineering projects by supplementing a new case study related to Sichuan's construction industry.

Keywords: Residential Buildings, Timber Structure, Sichuan Province, Construction Preference, Stakeholder Management

Heat-proof Design of Buffer Space in Sea Dwellings -- A Case Study of Danjia Boat House

Sun Qianqian

College of Architecture, Xi'an University of Architecture and Technology, Xi'an, China

Email address:
sunqianqian1024@126.com

Abstract: Sea dwellings are one of the important types of dwellings in hot and humid areas. They are the wisdom of people's continuous exploration and adaptation to the natural environment. Their buffer spaces play an important role in regulating the indoor thermal environment. From the buffer space layout and scale shape of marine dwellings, this paper summarizes their adaptability to natural climatic conditions such as strong solar radiation, high temperature and high humidity. The study found that the large awnings on the outside of the eaves of the Danjia boat houses can effectively increase the shading coefficient and form the first thermal insulation barrier outside the main space of the building; the entrance is connected to the outdoor gray space, which is the transition space between the outdoor and the indoor. It is the second buffer space for the main space of the building. The auxiliary space is located on the west side of the main building to prevent the west from being exposed to the sun and form a thermal insulation space on the west side. The ground floor is overhead about 20 cm, which is conducive to natural ventilation to take away the moisture generated by the ground floor and prevent the building from getting wet. The axes of the doors and windows on the north and south sides of the living room are opposite, which enhances the natural ventilation of the room. This paper summarizes the thermal protection design of the buffer space of the sea dwellings, in order to enlighten the regional creation of the modern architecture of the floating dwellings in the hot and humid areas.

Keywords: Sea Dwellings, Buffer Space, Heat-proof Design

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