

PREFACE: ENERGY ISSUES IN CARBON CAPTURE

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Carbon dioxide is one of the main greenhouse emission gases throughout the world, which is harmful to the air environment and even to the society. A variety of CO₂ capture technologies have been extensively studied to reduce the CO₂ concentrations especially in industries (Zhang et al., 2018c,d). Carbon capture, utilization, and storage (CCUS) have especially been proven to be an effective and promising method to solve the environmental issues. Energy issue is a key influencing factor of the whole process efficiency (Vergragt et al., 2011).

This special issue of the *International Journal of Energy for a Clean Environment* focuses on energy problems in carbon capture. Nine research or review papers were collected addressing the diverse topics related to CO₂. The papers in this compilation provide key insight to the progress being made to better understanding of CO₂ absorption, chemical-looping combustion (CLC), CO₂ injection, etc.

Liang et al. (2018) studied a new ecological treatment of monoethanolamine (MEA) using lettuce hydroponics. The results showed that when a CO₂-rich MEA solution (< 0.001 mol/L) is contained in the chemical nutrition liquid for cultivating lettuce, the growth of lettuce improves with increase of the active lettuce life, substance assimilation capacity, apparent quality, and lettuce yield. Zhang et al. (2018b) discussed the state-of-the-art review of CO₂ absorption using various nanofluids, and three basic properties of nanofluids, i.e., thermal conductivity, viscosity, and convective heat transfer introduced in recent years.

Luo et al. (2018) found that the reactivity of natural iron ore in Inner Mongolia was comparable to that of synthetic $\text{Fe}_2\text{O}_3/\text{MgAl}_2\text{O}_4$ in CLC of coal. The high stability of the two materials was confirmed during 10 cyclic operation processes at 950°C. Therefore, the natural iron ore was found to be suitable for use in direct CLC process of Yimin coal. Cai et al. (2018) reviewed the development of a sustainable way for producing a hydrogen-enriched gas and increase or maintaining of the CO_2 capture capacity of CaO-based sorbents. Lv et al. (2018) reviewed the technologies, strategies, and lifestyles involved in low carbon community, and analyzed the evaluation tools and indicators to provide important references for policy makers.

Zhang et al. (2018a) investigated the waste heat recovery from coal-fired power plant and compared the thermodynamic performance of four kinds of organic Rankine cycle (ORC) with CO_2 capture systems. The Radar graph was used to analyze the selection of the working fluids. Qi et al. (2018) performed mechanistic studies of CO_2 dissociation into CO and O on the Ni_4 , Ni_3Pt , and Ni_2PtMg clusters via density functional theory (DFT) calculations.

CO_2 foams are able to improve oil recovery by blocking high-permeable channels and mobility control, which are the main challenges of conventional CO_2 flooding. Daryasafar and Shahbazi (2018a,b) discussed the recent studies on the performance of various types of nanoparticles for CO_2 -foam stabilization at different environmental conditions. Meanwhile, they also studied CO_2 -foaming injection for enhancing oil recovery, especially the foam behavior in porous media.

Thus, the published papers included in this special issue of the *International Journal of Energy for a Clean Environment* demonstrate a useful synthesis of progress made in recent years in different research fields pertaining to CO_2 . What is clear from the works published to date, including those provided in this special issue, is that there is much work still to be done to identify the most effective methods for CO_2 capture, and to optimize their performance.

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REFERENCES

- Cai, J., Wang, Z., Zeng, R., Luo, M., and Tang, X., (2018) Application of Calcium-Enriched Industrial Waste as CO_2 Sorbent in CaO-Based Chemical Looping Gasification of Biomass for Hydrogen-Enriched Gas Production: A Review, *IJECE*, **19**, pp. 257–302.

- Daryasafar, A. and Shahbazi, Kh., (2018a) CO₂-Foam Injection for Enhancing Oil Recovery: A Brief Review, *IJECE*, **19**, pp. 237–256.
- Daryasafar, A. and Shahbazi, Kh., (2018b) Using Nanotechnology for CO₂-Foams Stabilization for Application in Enhanced Oil Recovery, *IJECE*, **19**, pp. 217–235.
- Liang, F., Te, T., Yu, G., Wang, W., He, Q., Yan, S., and Ran, Y., (2018) Ecological Treatment of MEA Aqueous Solution Using Hydroponic Method, *IJECE*, **19**, 143–155.
- Luo, M., Yi, Y., Xai, J., Liu, K., Wang, C., and Wang, Q., (2018) Performance Comparison of Iron Ore and Synthetic Iron-Based Oxygen Carrier for Chemical Looping Combustion of Coal, *IJECE*, **19**, pp. 157–174.
- Lv, Y., Bi, J., and Yan, J., (2018) State-of-the-Art in Low Carbon Community, *IJECE*, **19**, pp. 175–200.
- Qi, W., Fu, L., Huang, Z., Yang, Y., Chen, X., Song, J., and Xu, Z., (2018) CO₂ Dissociation on Ni-Rich Multimetal Cluster: Effect of Pt and Mg, *IJECE*, **19**, pp. 323–337.
- Vergragt, P.J., Markusson, N., and Karlsson, H., (2011) Carbon Capture and Storage, Bio-Energy with Carbon Capture and Storage, and the Escape from the Fossil-Fuel Lock-in, *Global Environ. Change*, **21**(2), pp. 282–292. DOI: 10.1016/j.gloenvcha.2011.01.020
- Zhang, L., Pan, Z., Shang, L., and Dong, L., (2018a) Thermo-Economic Analysis of Organic Rankine Cycle (ORC) with CO₂ Capture System for Coal-Fired Power Plant Waste Heat Recovery, *IJECE*, **19**, pp. 303–322.
- Zhang, N., Zhang, X., Pan, Z., and Zhang, Z., (2018b) A Brief Review of Enhanced CO₂ Absorption by Nanofluids, *IJECE*, **19**, pp. 201–215.
- Zhang, Z., Cai, J., Chen, F., Li, H., Zhang, W., and Qi, W., (2018c) Progress in Enhancement of CO₂ Absorption by Nanofluids: A Mini Review of Mechanisms and Current Status, *Renew. Energy*, **118**, pp. 527–535. DOI: 10.1016/j.renene.2017.11.031
- Zhang, Z., Chen, F., Rezakazemi, M., Zhang, W., Lu, C., Chang, H., and Quan, X., (2018d) Modeling of a CO₂-Piperazine-Membrane Absorption System, *Chem. Eng. Res. Design*, **131**, pp. 375–384. DOI: 10.1016/j.cherd.2017.11.024