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Editorial: Pollutant emission control in energy conversion process

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Editorial on the Research Topic
Pollutant emission control in energy conversion process

Copper slag is a solid contaminant with a high recovery rate. Reduction and separation are considered to be effective methods for the treatment of copper slag. How to control the formation of contaminants during this treatment process? Zuo et al. discussed the separation and migration behavior of elements in copper slag and used the obtained mechanistic results as a theoretical guide to optimize the operating parameters to reduce the formation of contaminants. Qi et al. prepared an adsorbent by mixing sludge and steel slag from a sewage plant. Subsequently, they investigated the adsorption of chromium ions using this adsorbent mixture. As part of the analysis, the authors performed various tests to study the physical properties of the pyrolysis products, among others. The article is significant in suggesting a viable method for the effective use of steel slag.

A recent review on this Research Topic is also available for the treatment of waste carbon cathode residues from aluminum electrolysis. Li et al. provide a comprehensive summary of the rationale and technical characteristics of safe disposal strategies for this hazardous waste and offer a unique perspective on the recovery and application of valuable components from waste carbon cathodes. They summarized and discussed the latest treatment methods for waste carbon cathodes, including physical activation, alkali melting, alkali leaching, and high-temperature graphitization. They also presented a balanced, comprehensive and critical view on the development direction of clean disposal and resource utilization of waste carbon cathode residues.

For non-metallic wastes, Wei et al. investigated the adsorption and desorption performance of waste ion exchange resin-based activated carbon on fixed-bed CO_2. The adsorption temperature, gas flow rate, CO_2 concentration and adsorbent filling amount during adsorption, and the desorption temperature, CO_2 concentration and purge gas flow rate during desorption were investigated. The successful completion of this work is of great significance to the industrial application of CO_2 adsorption on waste ion exchange resin-based activated carbon and the development of carbon capture technologies.

Titanium sponge is a main raw material for the industrial production of titanium alloys. In the production of titanium sponge, the production energy consumption can be reduced and the quality of titanium sponge can be improved by enhancing the heat transfer in the

reactor. Wang et al. used a waste heat energy recovery system with forced heat transfer design to enhance the surface heat dissipation of the Kroll reactor and thus reduce carbon emissions. Also based on experimental data, a new Nusselt correlation for the heat exchange between cooling air and the outer surface of the reactor or the inner surface of the heater was developed, taking into account the cooling air characteristics, equipment and operating parameters. Subsequently, the Nusselt correlation was innovatively used to evaluate the heat transfer characteristics of the Kroll reactor in titanium sponge production, which is expected to facilitate the commercialization of forced heat transfer design and optimize the titanium sponge production process efficiency. Meanwhile, Yang et al. experimentally investigated the channel heat transfer and the flow characteristics of the fluid in a channel, and obtained a Nusselt correlation to predict the heat transfer characteristics, thus proposing a solution to the blockage of the U-shaped channel in the decompression distillation process of titanium sponge, which helps to reduce the production energy consumption and improve the quality of titanium sponge.

Wang et al. synthesized dual-effect nickel-based catalysts modified by Ce, Mg and Fe, respectively, by the co-precipitation method for enhanced steam reforming of coal tar. The catalysts were investigated for the effect of different doping mass ratios on the syngas composition. How to effectively control the flue gas from coal combustion in thermal power plants has been a Research Topic of interest. Selective catalytic reduction has been widely used as an effective flue gas treatment technology. Xie et al. used reinforcement learning techniques to design an intelligent controller to precisely control the ammonia injection to achieve higher denitrification, effectively reducing the NO_x content, resulting in less secondary pollution.

Although a large number of studies have been devoted to the heat transfer and pressure drop characteristics of condensation in pristine micro-fin tubes. Liu et al. reported the first experimental study on the effect of tube expansion on the heat transfer and pressure drop characteristics during condensation in micro-fin tubes by comparing the performance of micro-fin tubes before and after expansion, which is a very important Research Topic in the field of HVAC. Meanwhile, Liu et al. reported the two-phase flow state and transition of refrigerant R152a throughout the condensation process in a circular glass microchannel, a study of great importance for energy saving and emission reduction in the refrigeration and air conditioning industry. Because of the favorable thermophysical and environmental properties of R152a, it is a potential alternative for R22 and R134a, and it is important to study the two-phase flow state of R152a for low carbon and environmental protection.

Shallow geothermal energy is one of the forms of cooling and heating sources for refrigeration and air conditioning, and energy is extracted through ground source heat pumps. Due to the high initial investment cost of ground source heat pump systems, the local geological environment needs to be evaluated before designing a ground source heat pump to ensure that the energy utilization efficiency of the system is improved. Dong et al. proposed for the ground: firstly, four attribute indices and 11 element indices of geological-hydrological-geological conditions, engineering-geological conditions, thermophysical conditions and environmental conditions of Qingdao area were detected, and then their weights were analyzed and calculated to obtain effective evaluation criteria. The method can provide guidance for the development of ground source heat pumps in specific areas, provide insight into the geothermal energy potential assessment methods, and is particularly valuable for understanding the role of geotechnical conditions in geothermal energy potential.

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Author contributions

YF provided the original draft preparation; ZZ, ZC and SL provided review and editing; MA and HX provided the conceptualization.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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