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Editorial: Materials for thermal safety enhancement in energy industries

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Editorial on the Research Topic
Materials for thermal safety enhancement in energy industries

Energy is the source of life, and the modern society cannot operate without power. The traditional energies utilized by the human include coal, petroleum and gas, while the new energies in the last two decades mainly consist of hydrogen, solar energy and various kinds of cells. However, there are many thermal hazard accidents during the energy utilization. The thermal safety of energy is a critical issue in modern society. Therefore, it is important to investigate and design materials for thermal safety enhancement in energy industries.

Based on these premises, the present Research Topic in "*Frontiers in Materials*," Section "Energy Materials" entitled "*Materials for thermal safety enhancement in energy industries*," aims to attract the latest progress around thermal safety issues and seek approaches to alleviate the thermal risk during the energy production, storage, transition, and utilization, etc.

Up to now, this journal has included four high-quality articles, and the specific introduction is as follows. In "Microstructures, absorption and adhesion evolution of FeCoCr/silicone resin coatings at elevated temperature", Yuan et al. prepared and evaluated the electromagnetic/mechanical properties of a heat-resistant microwave absorption coating based on FeCoCr and silicone resin. At temperature up to 400°C, the FeCoCr powders exhibited stable nanocrystalline structure of body-centered cubic and electromagnetic properties. The adhesion of FeCoCr/silicone resin coatings showed great increase with the extension of heat treatment time. The heat treatment reduced the complex permittivity of the coating while raised the complex permeability. This work has indicated the route to achieve high performance heat-resistant microwave absorbing coatings (Yuan et al.).

In "Suppression characteristics of multi-layer metal wire mesh on premixed methane-air flame propagation", Feng et al. uses the high-speed photographic schlieren system to observe the microstructure changes of methane explosion flames passing through different layers of metal wire mesh. Based on the characteristic parameter law of explosion dynamics, the dynamic characteristics of metal wire mesh suppressing explosion flame propagation are obtained. The suppression effect of the wire mesh is influenced by the flame propagation behavior and combustion state in the pipe. The microstructure of the premixed methane-air flame front is destroyed by more mesh layers and higher mesh density, thus, the flame propagation is hindered, and the premixed flame temperature and explosion overpressure are lower (Feng et al.).

In “Numerical simulation study on suppression effect of water mist on PMMA combustion under external radiant heat flux”, Zhao et al. built numerical model of PMMA under external radiant heat flux and tested combustion characteristic parameter such as ignition time, surface temperature, heat release rate and flame temperature. The theoretical calculations of combustion parameters agree well with experimental measurements. Theoretical calculation shows that the water mist with 0.9 $L/(min \cdot m^2)$ in flow rate can prolong the ignition time of the sample under 50 kW/m^2 radiation to 1100 s, and this results could help the fire prevention and extinguishment for typical solid material in practice (Zhao et al.).

In “A control method for hydraulic fracturing of the hard roof with long and short boreholes”, Ma et al. put forward a control method for hydraulic fracturing of the hard roof in mine field. To understand the mechanism of crack propagation caused by hydraulic fracturing of the roof, the shear fracture criterion was determined for the formation of horizontal fractures in the natural cracks. The formation of cracks involves a vertical main crack and multiple extended-airfoil branch cracks which interconnect transversely and longitudinally. The hydraulic fracturing technology for controlling the hard roof has been applied in No. 2 Well of Sihe Coal Mine for many years. The research results help control the hard roof in other similar mines (Ma et al.).

Overall, the articles published in this Research Topic cover the materials for thermal safety enhancement in energy industries. We hope that contributions published within this issue will contribute to a new insight into the field of safe materials in energy, exploring more possibilities of achieving safer application of multiple kinds of energies.

Author contributions

YZ: Conceptualization, Supervision, Writing–original draft. BM: Conceptualization, Writing–original draft. MY: Writing–review and editing. KL: Writing–review and editing. FT: Writing–review and editing.

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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