

Chemical Engineering

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New cobalt-based metal-organic frameworks with the application in gas storage and separation

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Metal-organic framework (MOF) has attracted people's attention because of their diverse porous structures and potential to be applied in the area of gas separation, catalysis, sensing, and energy storage. We present the synthesis and characterization of a novel cobalt-based 3D MOF, $[\text{Co}^{\text{II}}(\mu_3\text{-OH})(\text{ipa})_{2.5}(\text{C}_2\text{H}_5\text{OH})_{0.5}(\text{DMF})_2]$, which is constructed based on trimeric $\text{Co}_3(\mu_3\text{-OH})$ secondary building unit (SBU). The synthesized sample can be used in gas storage and separation based on its novel structure. MD simulation and corresponding experimental studies were carried out for further discussion.

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Energy efficiency alone is not enough

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Forty years ago, in response to energy crises, energy efficiency (EE) measures were introduced to mitigate petroleum production shortages and associated skyrocketing fuel costs. When the crises ended, the perceived value of EE declined. Fast-forward to the 21st century where climate change and resource depletion can no longer be ignored. Consequently, the magnitude and scale of EE techniques and measures applied in various industries has soared. Everybody has jumped on the EE bandwagon because they see it as a means to cut costs and emissions, and to build a profitable business. Today, in the midst of catastrophic weather events and dwindling energy supplies more issues arise, such as energy security and resilience. Energy Efficiency is extremely important but it's only part of the solution. Why? Energy Efficiency saves money but employing EE alone is like cutting your monthly budget without adding to your paycheck. Example: San Pedro ports estimate their energy demand will triple or even quadruple in the next few years (shore power, automation, etc.). The local utilities will not be able to guarantee the supply. The ports are seeking alternative solutions to meet the growing demands like Port of Long Beach (POLB's) "Energy Island". In addition, sustainable practices have been incorporated into the ports' planning, designing, construction, purchasing, and operations. Since 2005, the Green Ports have cut emissions substantially, i.e. DPM by 80%, NOx by 50%, SOx by 80%. To address issues of energy security we need a holistic energy strategy that includes energy efficiency, availability, reliability, independence, resilience, and innovations. Rating systems like LEED and Envision exemplify this concept. While LEED has become a globally recognized green building program, infrastructure projects remained unaddressed until the Institute for Sustainable Infrastructure developed Envision. Envision provides a holistic framework for evaluating and rating the community, environmental, and economic benefits of all types and sizes of infrastructure projects.

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