PURDUE INNOVATES | Office of Technology Commercialization

Electrical Heat Exchanger Apparatus and Reaction Technology (E-HEART)

A multi-stage electrically heated reactor platform that precisely controls temperature and easily integrates intermittent renewable power.

Researchers at Purdue University have developed a mechanism termed Electrical Heat Exchanger Apparatus and Reaction Technology (E-HEART) that dynamically modulates reactor temperature in processes involving variable feedstock and power delivery conditions. Heated apparatuses are particularly important for facilitating endothermic and exothermic processes such as cracking or thermal decomposition. However, available apparatuses fail to directly integrate renewable energy sources due to intolerance to changes in feedstock and power delivery conditions. Energy storage has been used to combat these pitfalls, but this solution incurs high costs and compromises product integrity. Methods to achieve precise temperature control for productivity improvement are still direly needed.

E-HEART helps chemical manufacturers and hydrocarbon processors efficiently conduct thermal processing for reactants and hydrocarbons. By enabling precise temperature control and dynamic modulation of process conditions, this heating mechanism can handle variations in feed conditions and power delivery without compromising product quality or reaction temperature. Simpler and more efficient than existing heating apparatuses, E-HEART excels in decarbonizing chemical reactors and directly integrates renewable energy sources.

Technology Validation:

The researchers compared cracking processes of a feed stream in a conventional heated reactor with E-HEART. The E-HEART units exhibited superior performance for variable process conditions compared to the conventional units. Results also demonstrated E-HEART's ability to efficiently handle diverse operating conditions by independently controlling heating elements.

Advantages:

Technology ID
2024-AGRA-70615

Category
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

Further information
Will Buchanan
wdbuchanan@prf.org

View online

-Multi-stage design enables precise control of temperature and heat profile across the unit

-Precipitates dramatic carbon emission reductions while simultaneously boosting production quality

-Tolerates changes in process conditions and regulates temperature control

-Direct integration with renewable energy sources

Applications:

-Chemical manufacturers

-Hydrocarbon processors

-Large oil and chemical companies

TRL: 3

Intellectual Property:

Provisional-Gov. Funding, 2024-03-06, United States

PCT-Gov. Funding, 2025-03-06, WO

Keywords: Electronics, Lasing, LIDAR, linear perovskite nanowires, Materials and Manufacturing, Micro & Nanotechnologies, Photonics, Semiconductors