

Innovative microreactors for developing new biofuels and bioenergy processes

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Although closing the loop for our resources solves some of the today's most acute environmental issues, it makes the chemical processes much more difficult to design and operate. New reactors equipped with unconventional heating techniques are being established in many applications. In this regard, the PEARL of Polytechnique has developed five innovative reactors. The first one is the Microwave Thermogravimetric Analyzer (MW-TGA-1). It measures a payload mass as low as 300mg and uses a custom-made infrared thermometer equipped with a set of optical filters. To overcome the drawbacks of MW-TGA-1 related to collecting the products for the analytical purposes, MW-TGA-2 was built. It accepts a payload mass of a gram scale and can record the instantaneous yield of the products. The third microreactor also relies on electromagnetic irradiation. It is called Induction Heating Fluidized Bed Reactor and composed of lift tube and reaction zone. As a unique feature, the lift tube helps inject a mass of feedstock precisely in less than one second to the reaction zone. The fourth reactor is a Fluidized Bed Thermogravimetric Analyzer. The maximum reacting non-fluidized solid sample of 5g can be thermally treated at a temperature up to 1200°C. Since it is not recommended to use gasses for the fluidization purposes in pyrolysis, a saddle reactor has been built. It consists of two V-shaped pairs of arms connected at their bottoms, one of which is twisted by 90°. The outlet of the reactors mentioned above is connected to several analytical techniques to analyze the gas product.

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