Material characterization using a Tandem micro-Reactor – GC–MS

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Abstract:

This work illustrates how the Tandem micro-Reactor (TMR), when interfaced to a GC–MS, facilitates the rapid characterization of virtually any material: gases, liquids and solids. A TMR has two independently controlled micro-reactors in series. Each micro-reactor has three heating modes: isothermal (up to 900ºC), multi-linear (e.g., 100–400ºC at 20ºC/min) and distinct temperature steps (e.g., 100ºC, 200ºC, etc.). The TMR can be used for both Evolved Gas Analysis (EGA) and detailed component analysis. Three examples illustrate how the TMR-GC–MS can be configured to differentiate or identify virtually any material. (1) Lignin, oak, bagasse and cellulose are easily differentiated using EGA–MS – each material is analyzed directly by simply weighing the sample (<75 mesh) into the sample cup. (2,3) The temperature dependence of ethanol and methanol transformations to ethylene and propylene, respectively, are presented using an online, real-time configuration. The ethylene transformation is also performed using a series of ethanol injections at distinct catalyst temperatures. Lastly, regeneration of the catalyst's surface is performed in-situ, which improves laboratory productive as well as elevating the precision of the data.

Frontier Labs products used:

Tandem micro-Reactor, Selective Sampler, MicroJet Cryo-Trap, Vent-free GC/MS adapter, UA+-1, UADTM-2.5N