Development of Tandem μ-Reactor-GC/MS system that allows for rapid screening and evaluation of catalysts

[Background] The characterization of a catalyst can be time-consuming, expensive and often requires a sophisticated pilot scale catalytic reactor. This Technical Note describes a new bench-top analytical system that is specifically designed for the rapid evaluation of catalysts in varied chemical and physical environments.

[Description] The system shown in Fig. 1 is based on interfacing a Tandem μ-Reactor (Rx-3050TR) with a GC/MS. The Tandem μ-Reactor, consists of two reactors in series (upper and lower), which are independently temperature-controlled. The temperature of each reactor can be rapidly and reproducibly heated and cooled.

The upper reactor (1st Reactor) is used to preheat a gaseous sample, vaporize a liquid, or pyrolyze a solid. The quartz insert tube is packed with a catalyst and placed in the lower reactor (2nd Reactor). Vapors from the 1st Reactor flow to the quartz insert tube in the 2nd Reactor, where they contact the catalyst. A Reaction Gas Controller utilizes mass flow controllers so that up to 3 reactant gases to be added to the sample vapors exiting the 1st Reactor prior to entering the 2nd Reactor. The reaction products exiting the 2nd Reactor flow directly into the GC for analysis. Using a deactivated tube for a GC column allows real-time monitoring of catalytic reaction products formed in the 2nd Reactor (RXA-001E).

A cross section of the quartz insert tube is shown in Fig. 2. The catalyst bed is positioned between two bits of quartz wool and springs, ensuring that the catalyst bed is not affected by pressure variations in the tube. The quartz insert tube can be replaced in a few minutes.

There are three temperature control modes for each reactor: isothermal, linear, and stepwise-temperature. Catalytic reaction products formed in specific temperature zones can be automatically analyzed if the system includes two optional accessories: Selective Sampler (SS-1010E)*1) and MicroJet Cryo-Trap (MJT-1035E)*2)

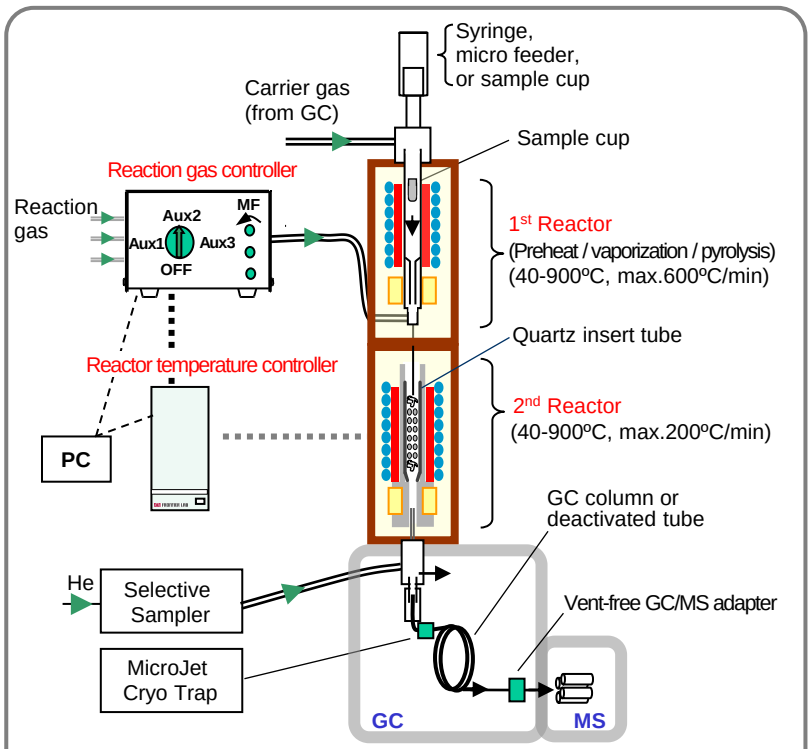

Fig.1 Diagram of the Tandem μ-Reactor–GC/MS system

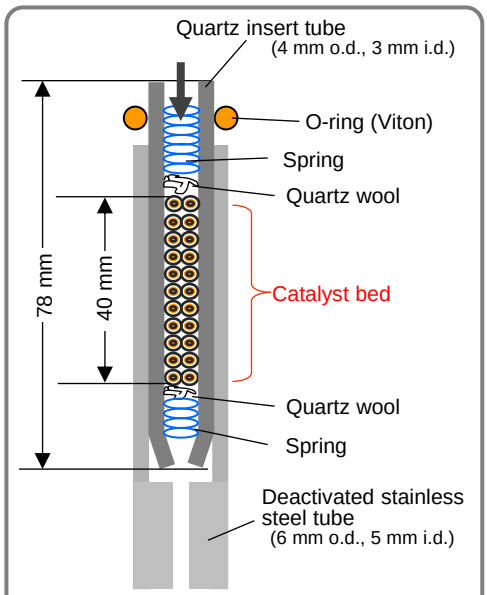

Fig. 2 Structure of quartz insert tube

*1), 2) please see the catalogue of each accessory for details.

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Keywords : Catalyst, screening, evaluation

Products used : Tandem μ-Reactor, μ-Reactor, Selective Sampler, MicroJet Cryo-Trap, Vent-free GC/MS adapter

Applications : Catalyst screening and evaluation

Related technical notes : RXA-001E, RXA-002E

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