Flexible Microreactor System for Chemical Research at Moderate and High Temperatures

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Miniaturization is fast gaining attention in chemical processes that are conventionally carried out on a lab-scale or larger. Recently, major progress has been made and several reactions in microscale have been studied by our group and others [1-5]. A microkinetic array system is being developed for fast catalyst development and process optimization. This paper focuses on the issues of microreactor system design, modeling and reaction characterization. Preferential oxidation of CO, which is a very important step to reduce CO in reformate fed to PEM fuel cell, was chosen as a model for developing a science-based microreactor design methodology with minimal empiricism. Catalyst preparation and reaction modeling are also discussed.

**Overall Design of the Microkinetic Array**
- The concept of microkinetic array and the first experimental array of 16-reactor array, on the left.
- Cross-section of 1.6 µm film catalyst with one winded channel and high temperature model, on the right.

**Microkinetic Array Under Development**

**Design of Interface Block—AutoCAD Design**

**Automation of Data Acquisition and Control—Data Diagram**

**Reactor Modeling in Microchannel: Preferential Oxidation**

**Initial Simulation Results**

**Summary:**
This paper summarizes the work on the design, characterization and analysis of a microreactor system. It emphasizes the system automation including flow, temperature and pressure control, and the reactor interface block design to gain a desirable thermal distribution. Reactor fabrication, reaction modeling and catalyst preparation methods are also introduced.