COLLEGE OF ENGINEERING
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

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Environmentally Friendly Propylene Epoxidation Process Using Silver Catalysts

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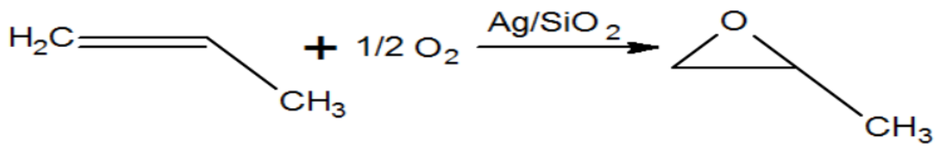
Introduction

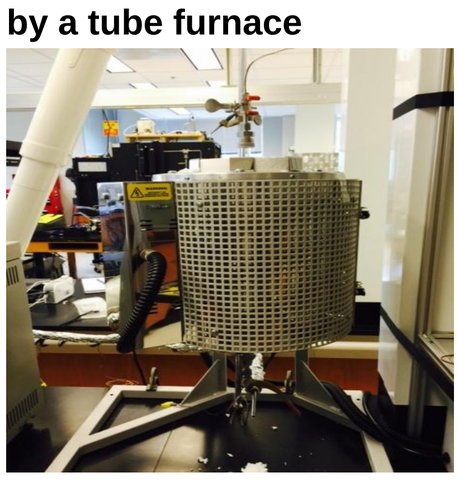
Propylene oxide (PO) is one of the most important and wildly used chemicals which have more than 6 million tons per year production worldwide. The methods for producing propylene oxide such as the chlorohydrins process, the hydroperoxide process and hydrogen peroxide to oxidize propylene have disadvantages among the environmental impacts and the cost of production. An environmentally friendly propylene epoxidation process is developed by using molecular oxygen as the oxidant and silver catalysts to reach higher selectivity of PO.



Silver nanoparticles are the industrial catalyst for the production of ethylene oxide from ethylene. The feasibility of using 8% weight percent silver catalysts to catalyze propylene epoxidation is investigated in this work.

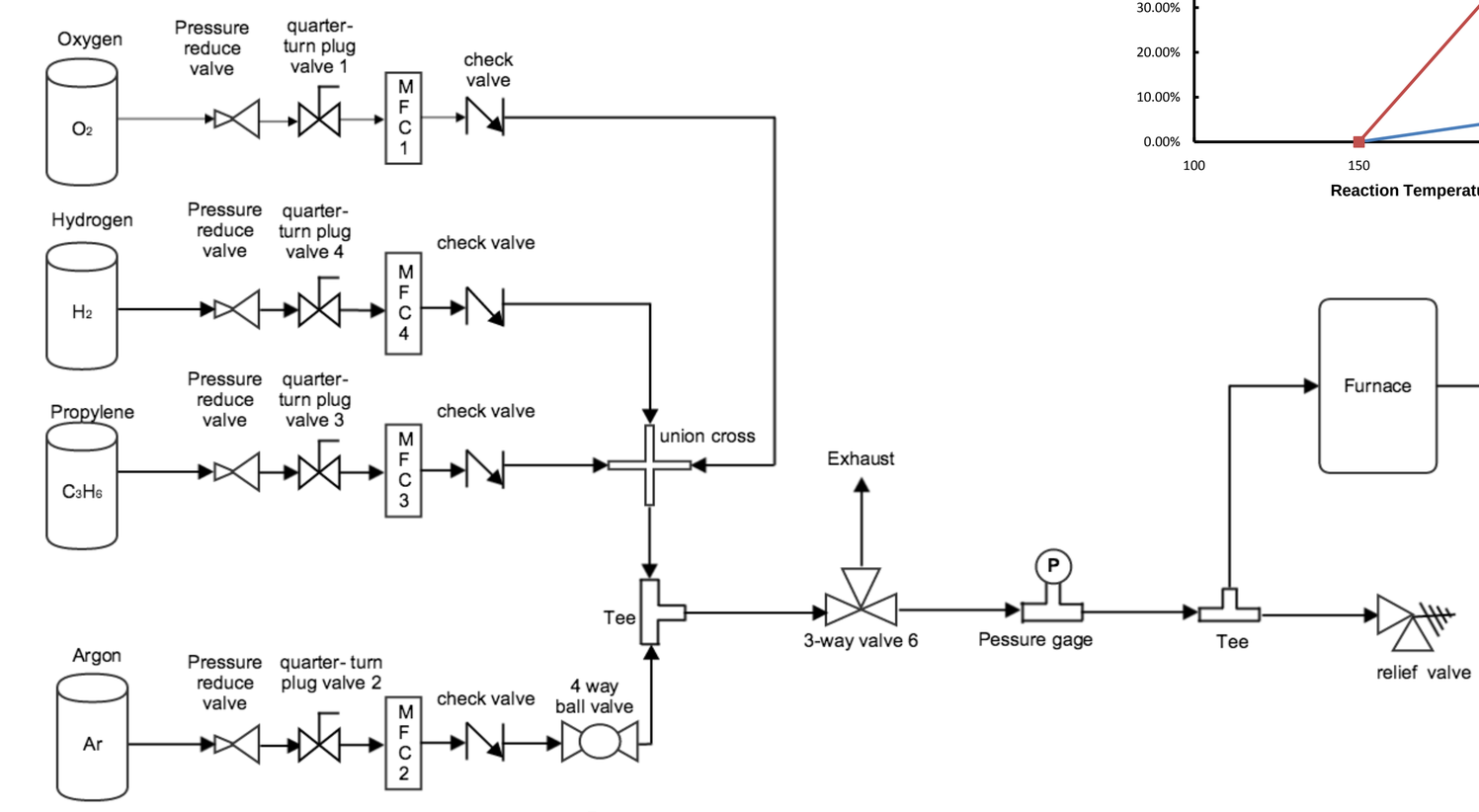
Methods

Tubular reactor heated by a tube furnace

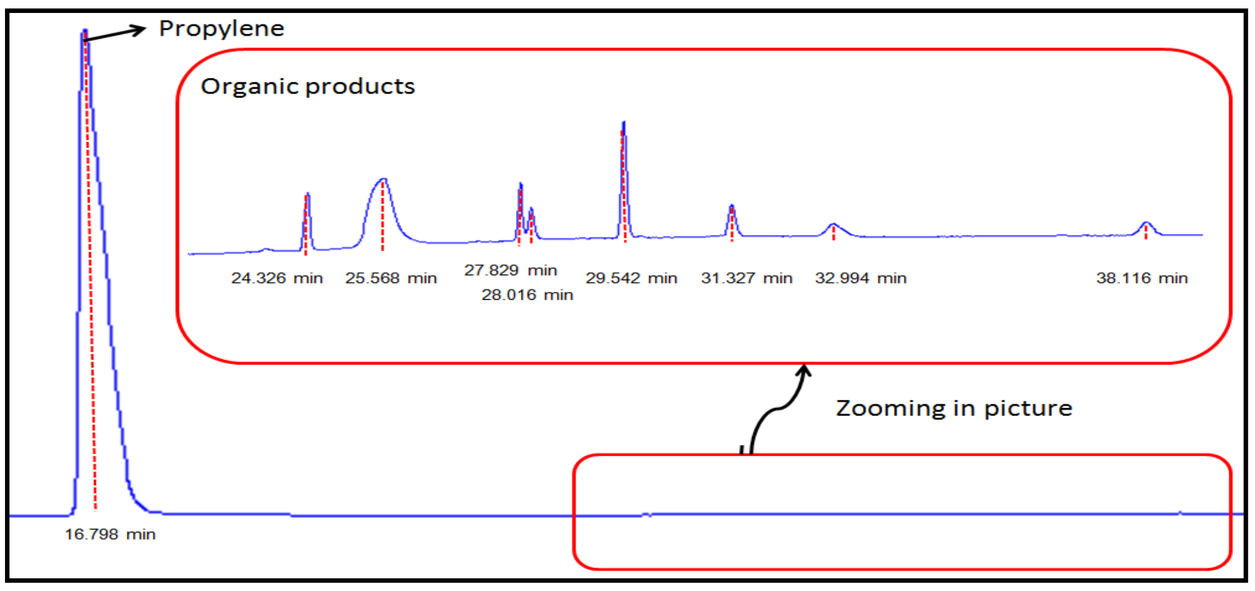


GC with both FID and TCD detectors

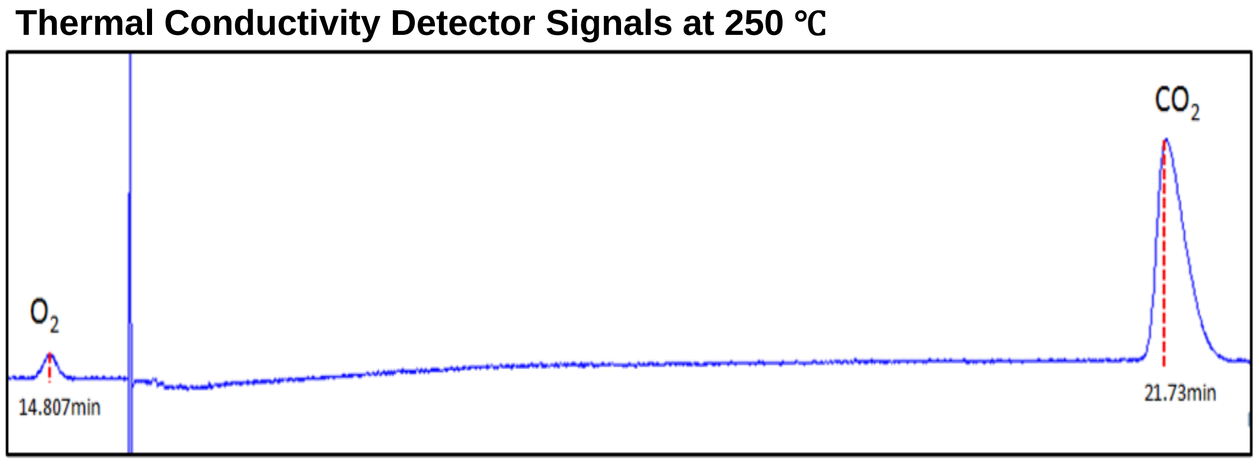
Flow diagram of the catalyst testing system



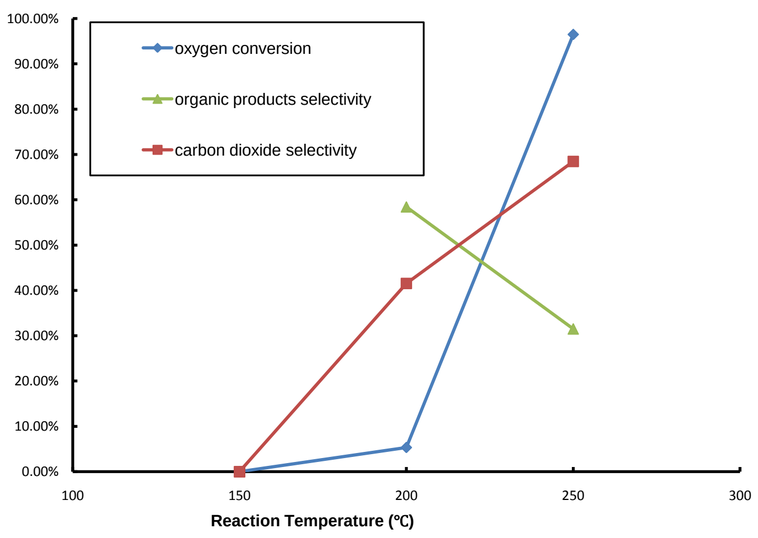
Flame Ionization Detector Signals at 250 ℃



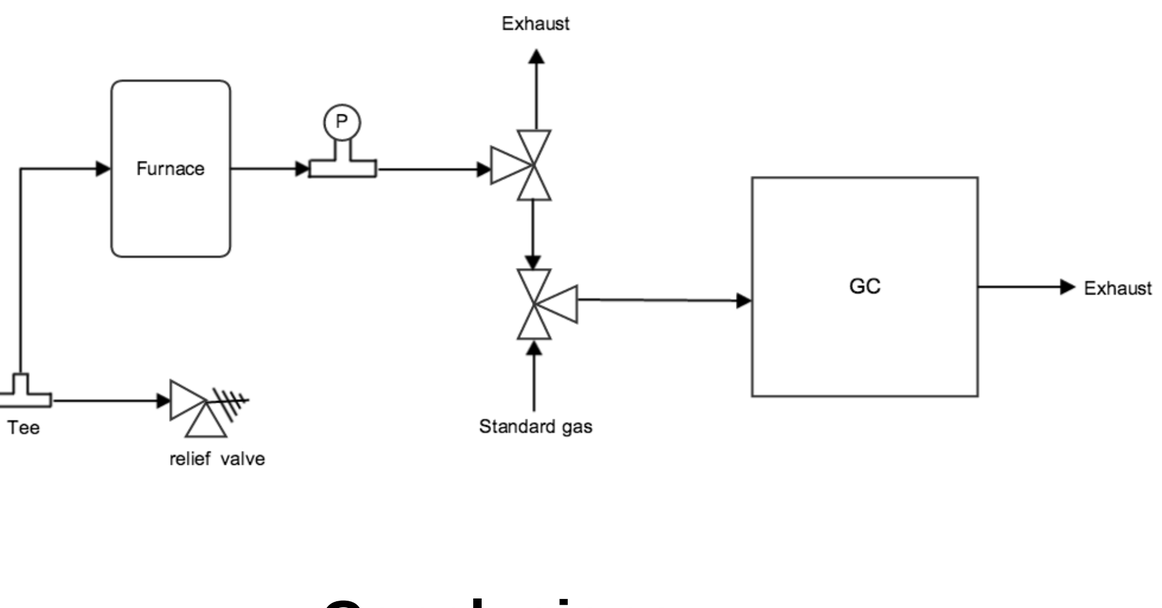
Thermal Conductivity Detector Signals at 250 ℃



Catalyst performance



- At 150 ℃, no visiable product was detected.
- At 200 ℃, CO_2 and organic products are formed. The conversion of O_2 is 5.4% while the selectivity of organic products is 58.4%.
- At 250 ℃, the conversion of oxygen increases to 96.5% while the selectivity of the organic products decrease to 31.5%.



Future Work

The organic products need to be specified and quantified. Other nano-catalysts for the direct gas-phase propylene epoxidation reaction can also be studied to achieve high conversion of reactants as well as high selectivity of PO.

Conclusions

- Catalyst performance strongly depends on the reaction temperature.
- The selectivity of organic products increased with increasing reaction temperature.
- Higher reaction temperature favors CO2 formation.

Acknowledgements

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