Selective Acetylene Hydrogenation

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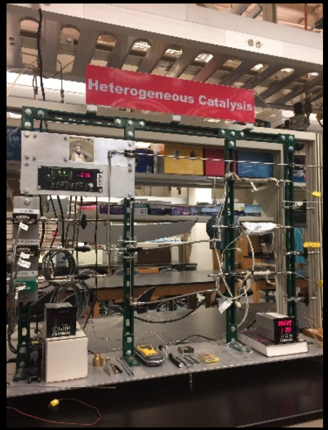
Problem:

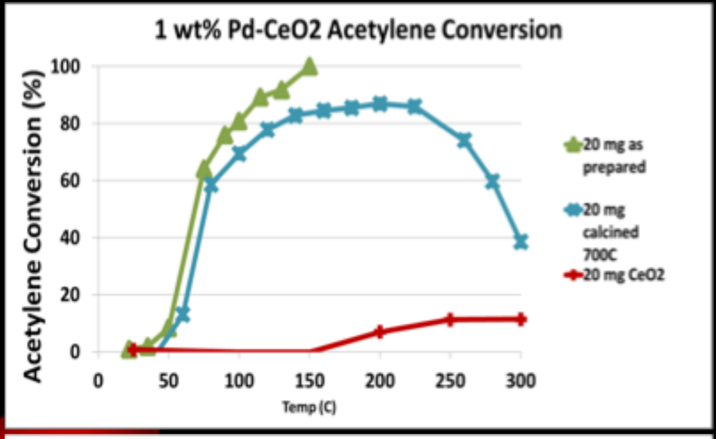
The production of ethylene from hydrocracking produces ethane. This is then converted to ethylene using a catalyst. Acetylene is also produced as a by product of this reaction, which poisons the catalyst used to convert ethane to ethylene. A selective catalyst to convert acetylene to ethylene and not ethane is needed.

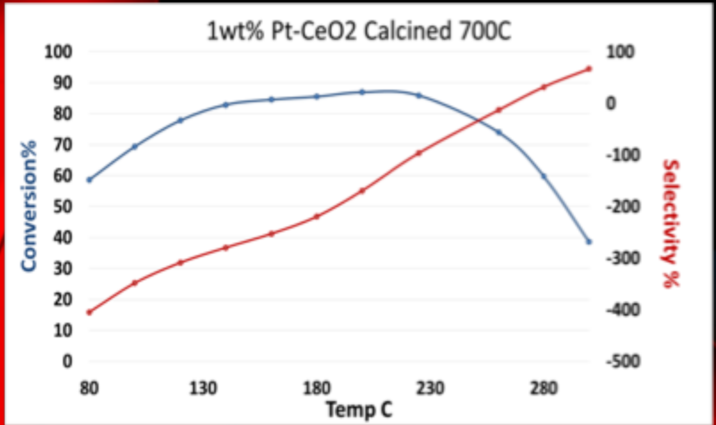
Method:



Using a reactor as shown, the prepared catalyst are loaded into a reactor tube. Then flowing hydrocarbons are let into the reactor tube. The output reactor lines are connected to a GC and data is collected on the composition of the outgas. Selectivity and Conversion are then calculated from the data collected from the GC.

Results:





- Palladium is too active for this reaction even in a dispersed state
    - Best selectivity seen was 67% at 40% conversion
    - At peak conversion after calcination was ~85% selectivity was ~ -169%
- Dispersed Platinum sinters to form large particles
    - Very low activity until reduction then nanoparticles form increasing activity but reducing selectivity

Future Research:

- Base metals like nickel and copper are cheaper than platinum.
- Nickel is known to be a good hydrogenation catalyst.
- In previous research by Chris Riley Copper also is a selective acetylene hydrogenation catalyst at high temperatures.
- This 30wt% Cu-Al2O3 Catalyst achieved 100% conversion while also being 100% selective