Supercritical Fuel Pyrolysis

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SUPERCRITICAL CONDITIONS FOR FUELS IN THE NEXT GENERATION OF HIGH-SPEED AIRCRAFT

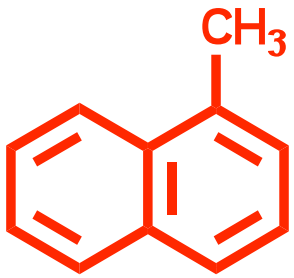
FUEL IS USED AS A COOLING AGENT IN HIGH-SPEED AIRCRAFT

HIGH PRESSURES AND HIGH TEMPERATURES ARE SUSTAINED IN THE FUEL LINES

PYROLYTIC REACTIONS PRODUCE POLY-CYCLIC AROMATIC HYDROCARBONS (PAH), PRECURSORS TO CARBONACEOUS FUEL-LINE DEPOSITS

TO UNDERSTAND THE REACTION CHEMISTRY, SUPERCRITICAL PYROLYSIS EXPERIMENTS ARE PERFORMED WITH MODEL FUELS

Model Fuels



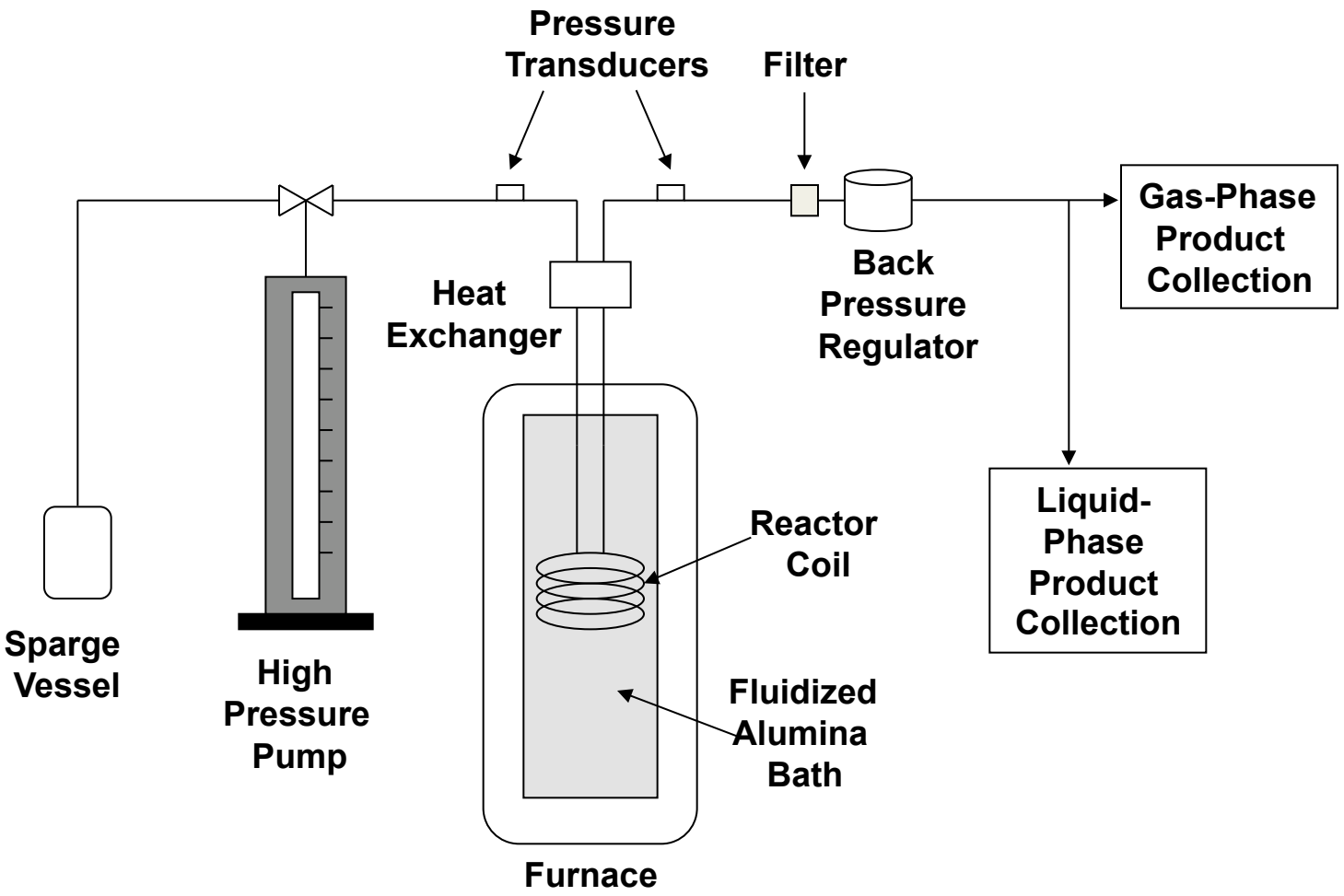
1-methylnaphthalene

T_c = 499°C
P_c = 36 atm

n-decane

T_c = 345°C
P_c = 21 atm

Supercritical Fuel Pyrolysis Reactor System



Summary and Conclusions

Supercritical 1-methylnaphthalene pyrolysis

- quantified fuel conversion and product yields, as functions of temperature, from 550 to 600 °C, at 80 atm and 140 s;
- PAH yields increase dramatically with temperature at the highest temperatures, especially for the largest PAH;
- differences in product yields related to mechanisms of formation.

Supercritical *n*-decane pyrolysis

- applied normal-phase HPLC fractionation / reversed-phase HPLC analysis;
  - demonstrates a 6- to 7-fold increase in the number of identifiable products;
  - greatly improves component resolution and quantifiability;
  - permits the identification of large PAH structures that may be key precursors to carbonaceous solids;
- identified 276 product PAH ranging in size up to 9 fused aromatic rings;
- quantified PAH product yields, as functions of temperature, from 530 to 570 °C, at 100 atm and 140 s;
- at 100 atm, PAH yields increase dramatically with temperature, especially as temperatures approach the onset of carbonaceous solids formation.

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Anyone interested in finding out more about this work can contact the principal investigator:

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