Supercritical Fuel Pyrolysis

Judy Wornat

Louisiana State University
Department of Chemical Engineering
Baton Rouge, Louisiana
U. S. A.

Supercritical Conditions for Fuels in Next-Generation High-Speed Aircraft

FUEL USED AS A COOLING AGENT IN HIGH-SPEED AIRCRAFT

HIGH PRESSURES AND HIGH TEMPERATURES SUSTAINED IN THE FUEL LINES

PYROLYTIC REACTIONS PRODUCE POLYCYCLIC AROMATIC HYDROCARBONS (PAH), PRECURSORS TO CARBONACEOUS SOLID DEPOSITS

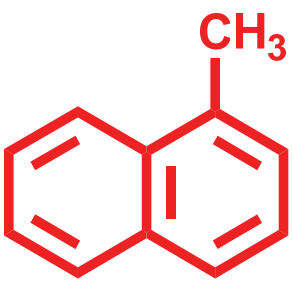
TO UNDERSTAND THE REACTION CHEMISTRY, SUPERCRITICAL PYROLYSIS EXPERIMENTS ARE PERFORMED WITH MODEL FUELS

Model Fuels

n-Decane

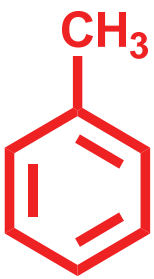
T_c = 345 °C
P_c = 21 atm

1-Methylnaphthalene



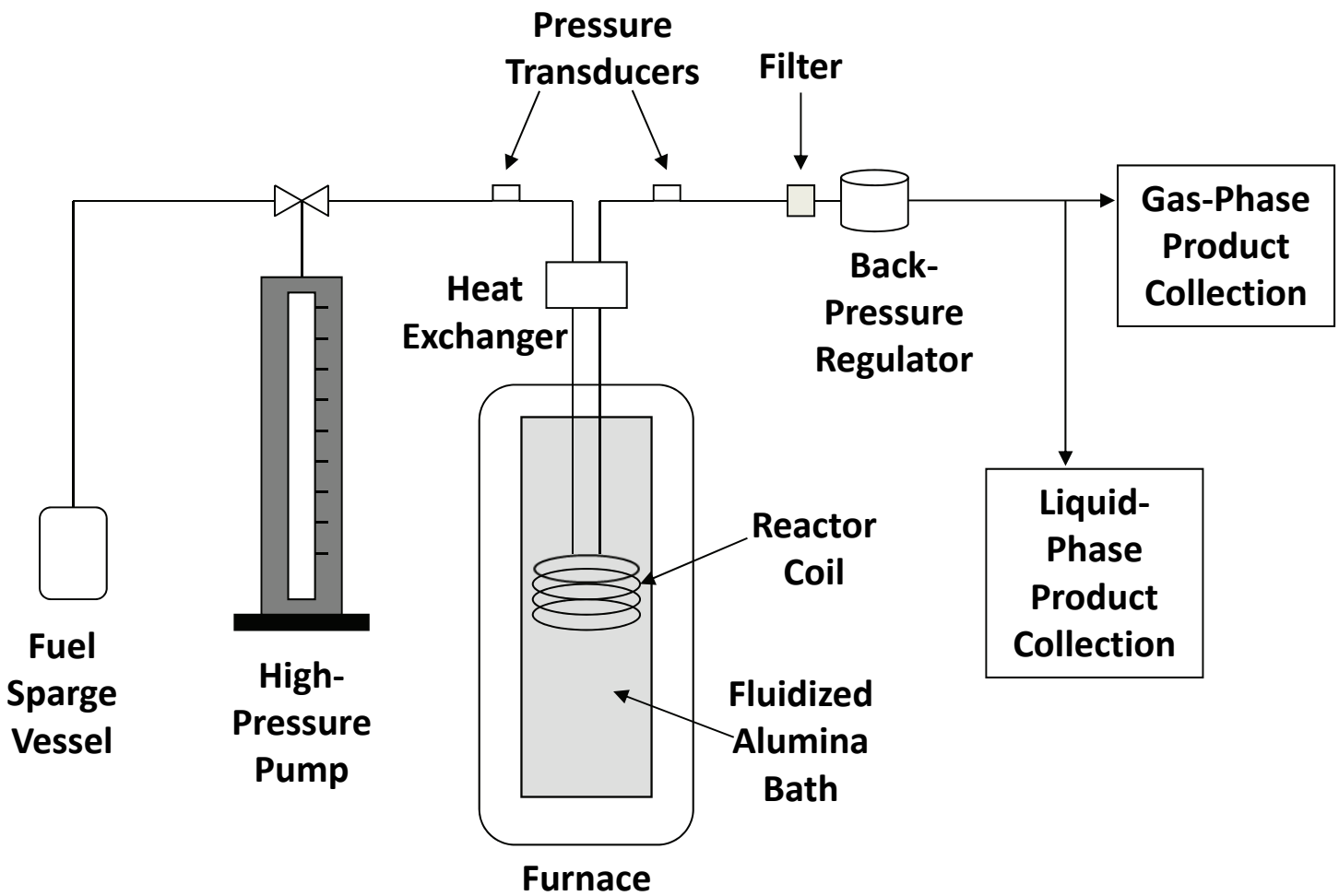
T_c = 499°C
P_c = 36 atm

Toluene



T_c = 319 °C
P_c = 41 atm

Supercritical Fuel Pyrolysis Reactor System



Summary and Conclusions

Supercritical *n*-decane pyrolysis experiments conducted at 100 atm, 133 sec, and at six temperatures from 530 to 570 °C. PAH products analyzed by HPLC.

The identified five-ring PAH products of *n*-decane belong to three isomer groups:

six $C_{22}H_{14}$ PAH and seven of their singly-methylated derivatives;

five $C_{21}H_{14}$ PAH;

seven $C_{20}H_{12}$ PAH and twenty-two singly-methylated derivatives.

Eleven of the eighteen unsubstituted five-ring PAH and all of their alkylated derivatives are first-time identifications as products of *n*-decane.

The three isomer groups of five-ring *n*-decane products also represented in the products of 1-methylnaphthalene; two of the groups represented in products of toluene.

The mechanisms of the formation of these five-ring PAH in the supercritical *n*-decane pyrolysis environment proposed.

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

Professor Mary Julia (Judy) Wornat
Louisiana State University
Department of Chemical Engineering
South Stadium Drive
Baton Rouge, Louisiana 70803

(225) 578-1426
mjwornat@lsu.edu