The stability of benzene in planetary atmospheres

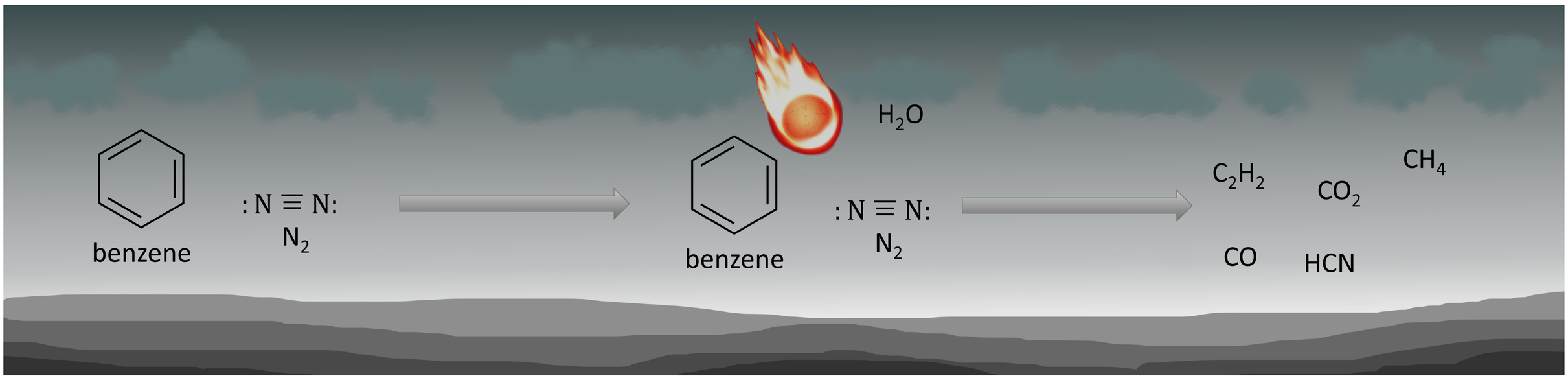
Antonín Knížek[a,b], Lukáš Petera[b,c]

CHARLES UNIVERSITY
Faculty of Science

[a]Department of Physical and Macromolecular Chemistry, Faculty of Science, Charles University, Hlavova 8, CZ12843, Prague, Czech Republic
[b]J. Heyrovský Institute of Physical Chemistry, Czech Academy of Sciences, Dolejškova 3, CZ18223 Prague 8, Czech Republic.
[c]Department of Inorganic Chemistry, Faculty of Science, Charles University, Hlavova 8, CZ12843, Prague, Czech Republic

J. Heyrovský Institute of Physical Chemistry

Scenario



Experiment

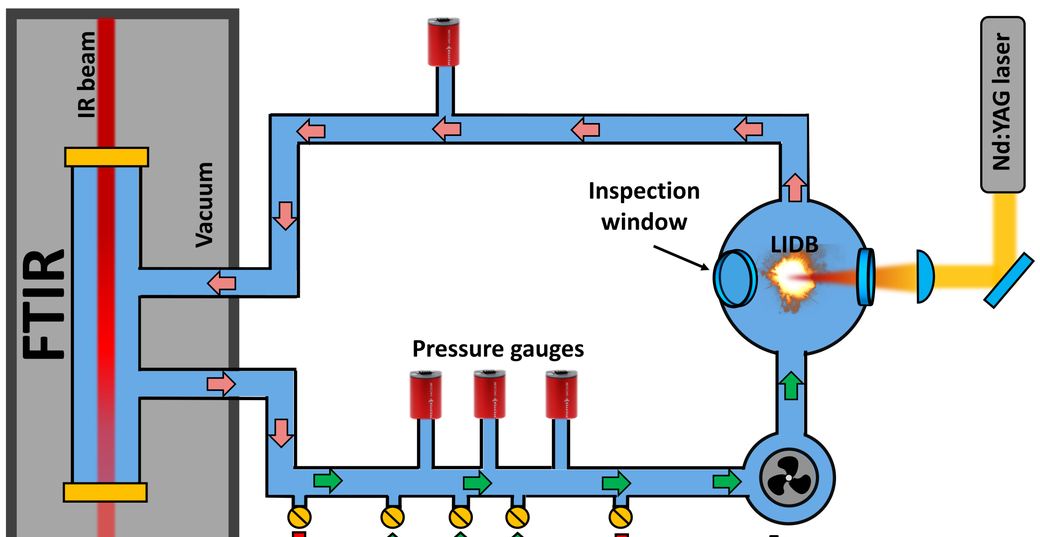
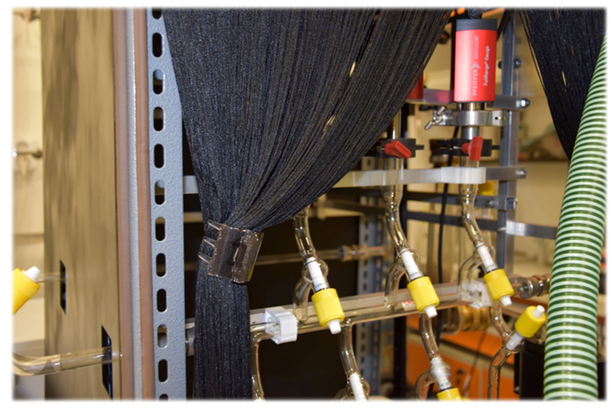


Figure 1: Schematic drawing of the experimental apparatus.



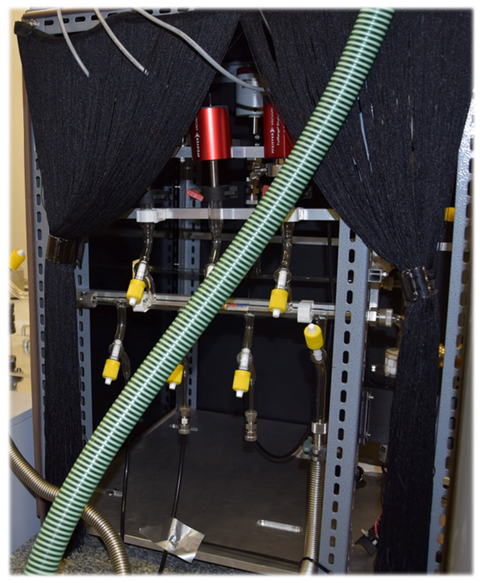


Figure 2: The experimental apparatus.

Results

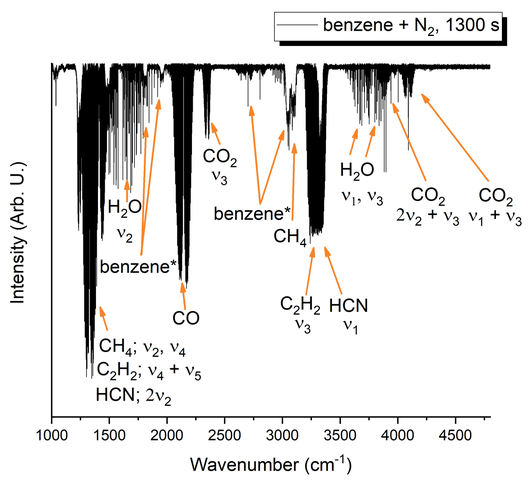


Figure 3: Gas phase spectrum of a mixture initially containing benzene and N_2, here after 1300 s of irradiation.

$$C_6H_6 \xrightarrow{h\upsilon} \text{products}$$

The benzene decomposition rate eq.

$$\frac{dp(C_6H_6)}{dt} = -\frac{k_1' p(C_6H_6)}{k_2' + p(C_6H_6)} \quad (4)$$

$$k_1' = k_1 p(C_6H_6)_i$$

$$k_2' = k_2 p(C_6H_6)_i$$

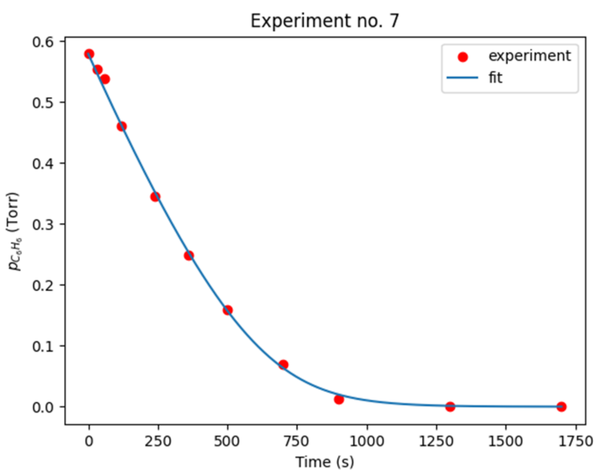


Figure 4: Partial pressure of benzene in experiment and the respective fit.

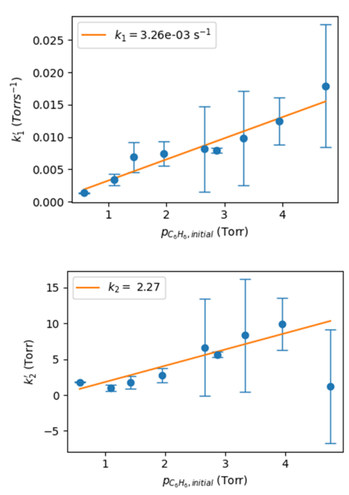


Figure 5: Fitted rate constants k_1 and k_2 versus the initial pressure of benzene.

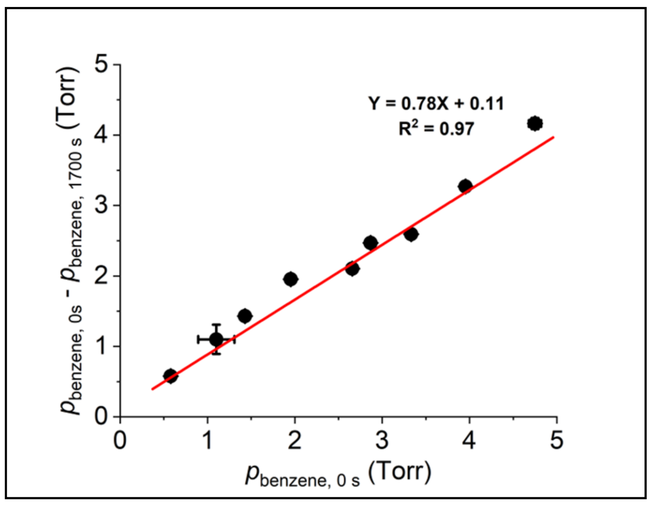


Figure 6: The degree of conversion of benzene

$$\xi_{1700\ s} = \frac{p_{\text{benzene, 0 s}} - p_{\text{benzene, 1700 s}}}{p_{\text{benzene, 0 s}}}$$

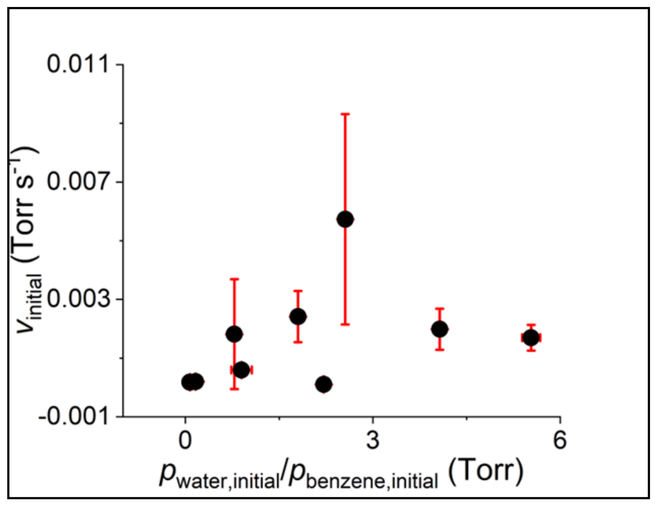


Figure 7: The initial benzene decomposition rate versus the relative amount of water at the beginning of the experiment. The benzene decomposition rate does not depend on the amount of water.

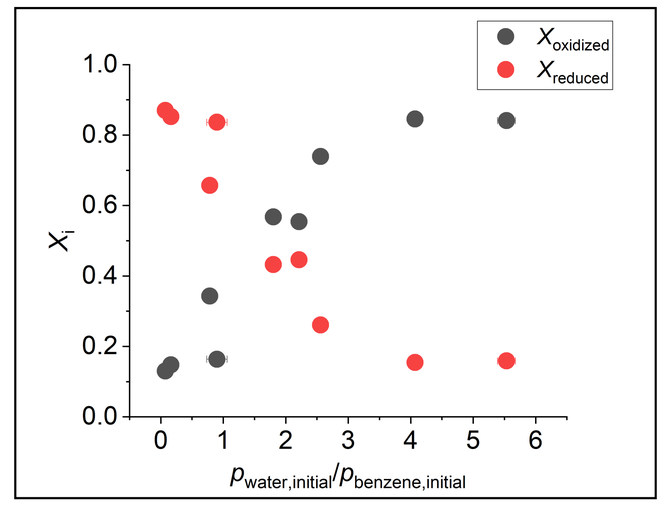


Figure 8: Molar fractions of oxidised (CO and CO_2) and reduced (HCN, C_2H_2, and CH_4) gaseous products after 1700 s of irradiation.

$$X_{\text{reduced}} = \frac{p_{\text{HCN, 1700 s}} + p_{\text{C}_2\text{H}_2\text{, 1700 s}} + p_{\text{CH}_4\text{, 1700 s}}}{p_{\text{HCN, 1700 s}} + p_{\text{C}_2\text{H}_2\text{, 1700 s}} + p_{\text{CH}_4\text{, 1700 s}} + p_{\text{CO, 1700 s}} + p_{\text{CO}_2\text{, 1700 s}}}$$

$$X_{\text{oxidized}} = \frac{p_{\text{CO, 1700 s}} + p_{\text{CO}_2\text{, 1700 s}}}{p_{\text{HCN, 1700 s}} + p_{\text{C}_2\text{H}_2\text{, 1700 s}} + p_{\text{CH}_4\text{, 1700 s}} + p_{\text{CO, 1700 s}} + p_{\text{CO}_2\text{, 1700 s}}}$$

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