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A five step pyrolysis mechanism for wood burning models

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Key Questions of Wood Pyrolysis

- Dependence on heating rate
- Dependence on sample size
- Product distribution
- Upscaling of laboratory TG results
- Appropriate global model
- Many similar experimental results, but many different interpretations.

Approach in this work

- TG measurements at several heating rates
- Three and five step global models developed using monomer formulas for wood components:

$C_6H_{10}O_5$ cellulose → gas + 2.5 C

→ 0.75 tar + gas + 0.625 C

$C_6H_{10}O_5$ tar → gas

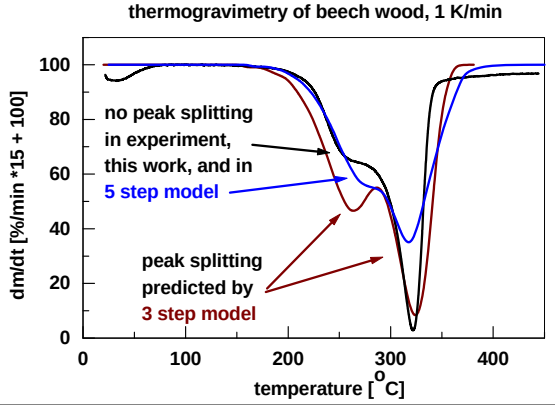
$C_5H_8O_4$ hemicellulose → gas + 2 C

$C_{10}H_{10}O_4$ lignin → gas + 4.3 C

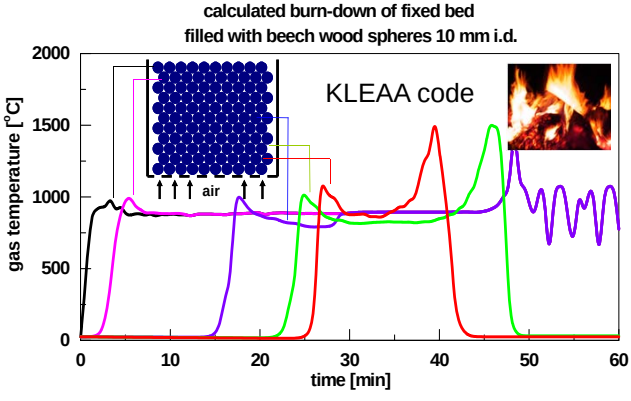
Properties of Global Models

- Rate constants fitted to global reactions are subject to the assumed mechanism, hence they are not exchangeable between different models, in contrast to elementary reactions.
- In 1 and 3 step models, fitted rate constants depend on heating rates, which is plausible only for samples of large size.

Comparison of 3 + 5 step Models with Experiment



Model Application to Fixed Bed Combustion



Model Calculation of Tar (Oil) Formation

Preliminary Results for Non-Isothermal Conditions