Combustion of single Wood Particles – Fuel-N Conversion

Claes Tullin[1], Jörgen Andréasson[1], Ola Ståhl[1], Martin Hansson[2], Bo Leckner[2] and Gennadij Palchonok[3]

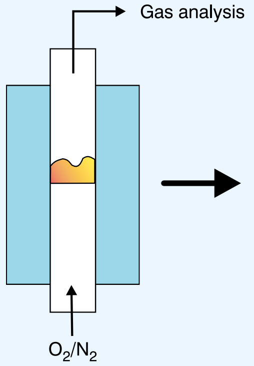
[1)] SP Swedish National Testing and Research Institute, Box 857, SE-501 15 BORÅS

[2)] Chalmers University of Technology, Energy Conversion, SE-412 96 Göteborg

[3] A. V. Luikov Heat & Mass Transfer Institute, National Academy of Sciences of Belarus,
P. Brovka 15, 220072 Minsk, Belarus

Experiments

Combustion experiments of single wood particles in an electrically heated quartz glass fluidised bed reactor give concentration vs time profiles (Figure 1.)



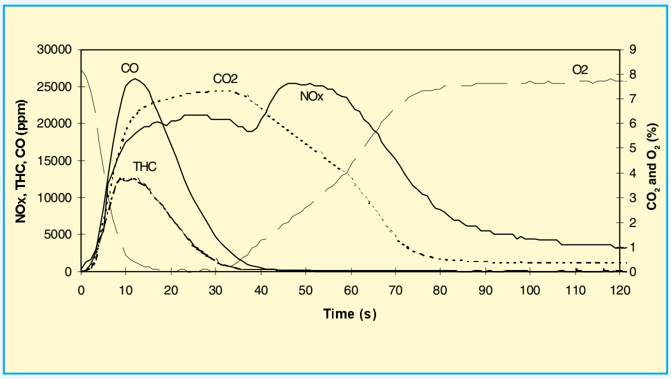


Figure 1. Concentration vs time profiles for the initial 120 s during combustion of a single pellet (type a1) in a fluidised bed at 1073 K and with 8% O_2.

Pellet	Diameter (mm)	Moisture (w-%)	Ash* (w-%)	Carbon* (w-%)	Hydrogen* (w-%)	Oxygen* (w-%)	Nitrogen* (w-%)	Eff. HV* (MJ/kg)
a1	10	6.8	0.4	51.0	6.3	42.2	0.053	19.00
b1	10	8.3	0.8	51.3	6.3	41.6	0.11	19.06
c1	8	7.1	0.5	50.9	6.3	42.4	0.21	18.88
d1	6	6.6	0.4	50.8	6.4	42.4	0.048	19.00
e1	6	9.0	0.4	51.0	6.4	42.3	0.079	19.14
f1	8	9.4	0.4	50.6	6.3	42.7	0.052	18.99
g1	8	7,1	0.4	51.0	6.4	42.2	0.058	19.00
h1	8	6.9	0.6	50.8	6.4	42.1	0.061	18.75

* Dry matter

Table 1. Fuel characteristics

Results

Effect of pellet type

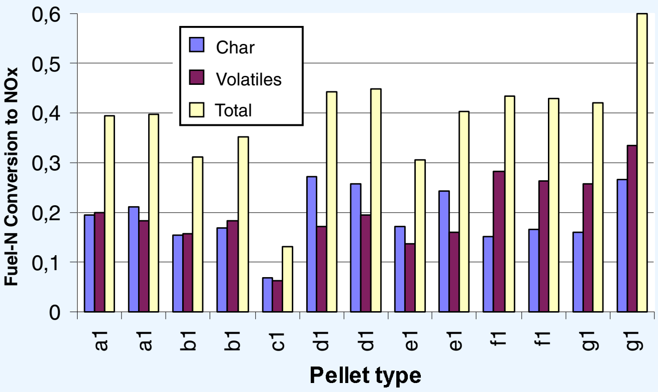


Figure 2. Fuel nitrogen conversion to NO_x for different pellets (cf. Table 1)

Effect of temperature

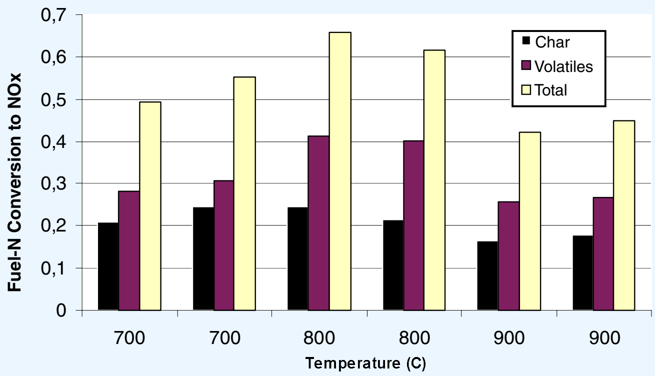


Figure 3. Effect of bed temperature on fuel nitrogen conversion to NO_x (14% O_2)

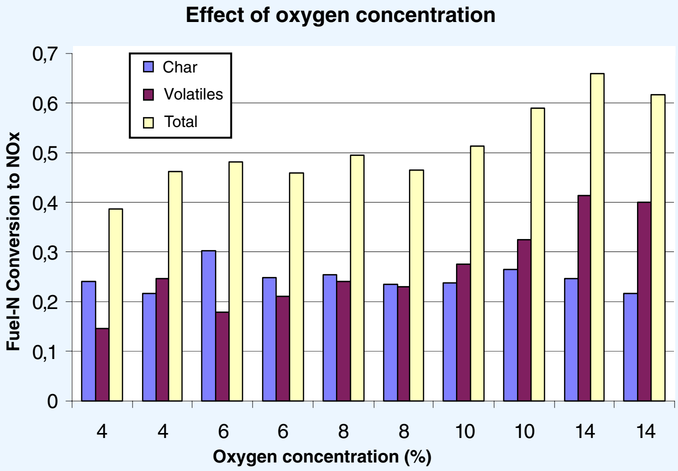


Figure 4. Effect of oxygen concentration on fuel nitrogen conversion to NO_x (14% O2)

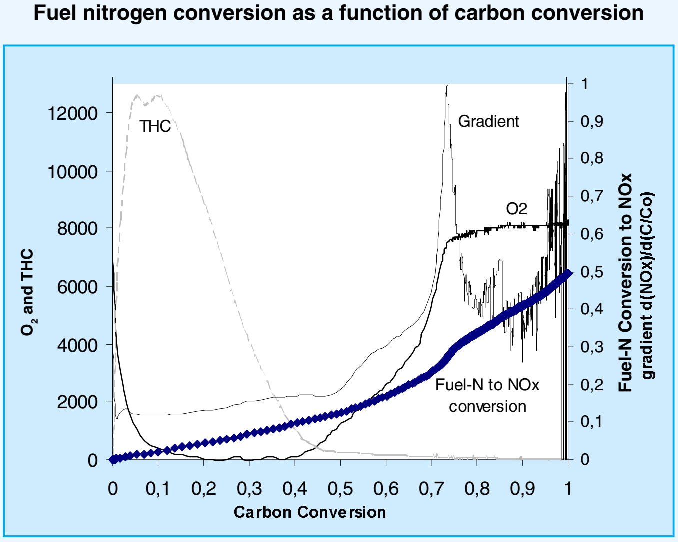


Figure 5. Fuel nitrogen conversion to NO_x as a function of carbon conversion (pellet type a1, 1073 K, 8% O_2, cf. Fig.1)

Discussion & Conclusions

The NO_x emission is a result of mechanisms of formation as well as destruction of NO_x and NO_x precursors.

Both the combustion of the volatiles and the residual char are important for the NOx emissions.

The NO_x net formation:

- is suppressed during the first part of the devolatilisation ($C/C_0 < 0,5$ in Fig. 5) due to reducing conditions
- increases slightly as as the THC and CO concentrations decrease and O_2 increases ($0,5>C/C_0 < 0,7$ in Fig. 5)
- increases sharply at the transition between devolatilisation and char ignition ($C/C_0 \approx 0,7$ in Fig. 5)
- increases as the O_2 concentration is raised due to less severe reducing conditions during devolatilisation (Fig. 4)
- decreases with increasing temperature in the temperature range investigated.

Acknowledgement

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