Points of interest on the route towards applying non-tyre rubbers as fuels for FBCs

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Points of interest on the route towards applying non-tyre rubbers as fuels for FBCs

Motivation

1 Behaviour while heating up

2 Special components

3 Pyrolysis

4 Fluidizability of the char particles

5 Char combustion

6 Tendency for bed agglomeration

Further steps

Motivation

Non-tyre rubber (WDF) → **Existing FBCs**

- high amount available
- negative price
- high calorific value

- flexibility against fuel quality

→

Motivation
Routine fuel analysis

moisture	0.5 – 0.6 %
volatile	45 – 55 %
ash	15 – 20 %
C	68 – 75 %
H	6 – 7 %
N	0.2 – 1.2 %
S	0.3 – 0.7 %
O	2.5 – 3 %
HHV	30 – 32 MJ/kg
density	0.8 – 1.2 kg/m^3
ash sintering temp	1060 – 1080 °C

1 Behaviour while heating up

personal experiences

&

literature reports

sticky

?

powder-like

1 Behaviour while heating up

sticky

experiments

powder-like

2 Special components

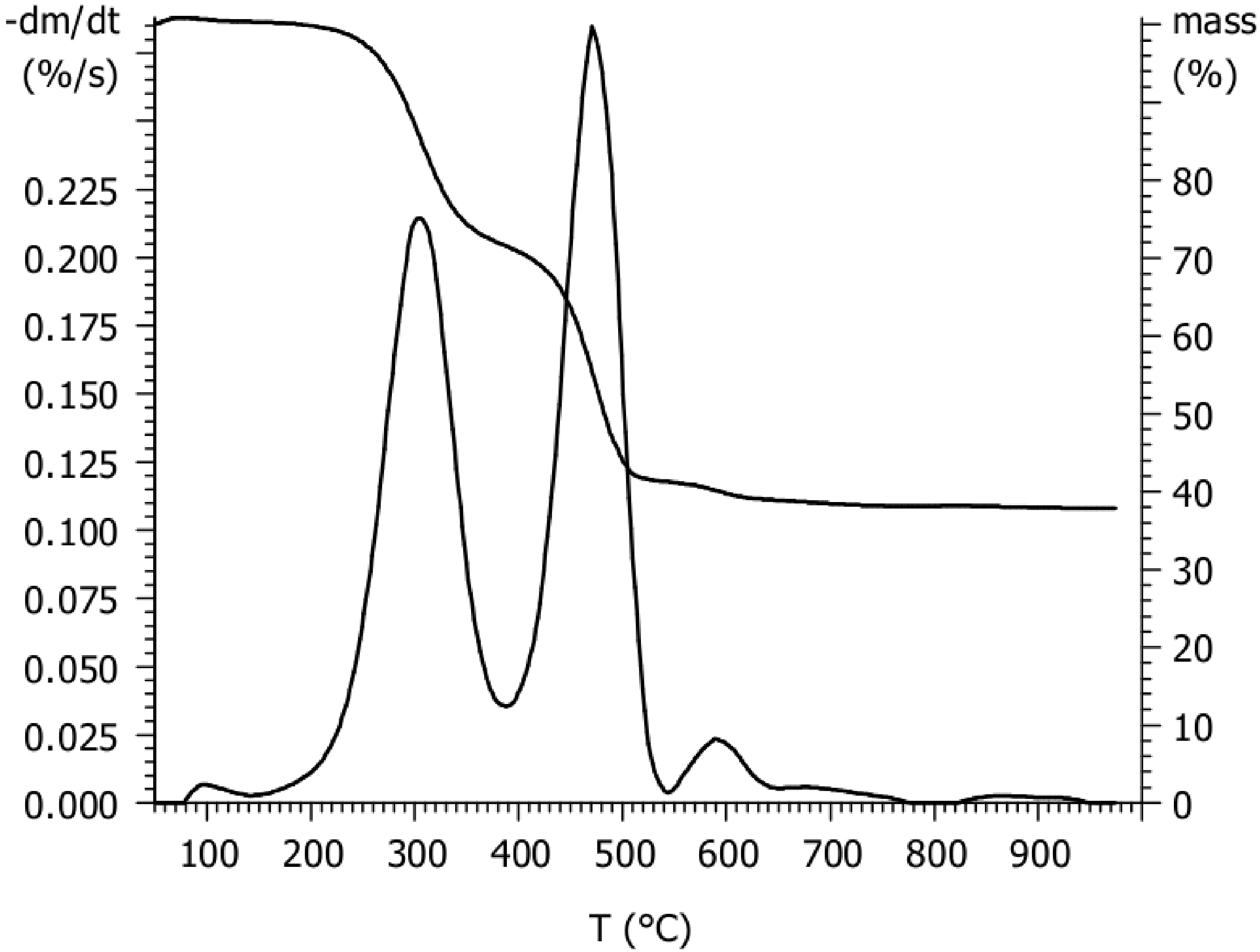
metallic fittings
- magnetizables marked

glass fibre mesh
- melts above 400°C
- melts → powder

PVC inner liner

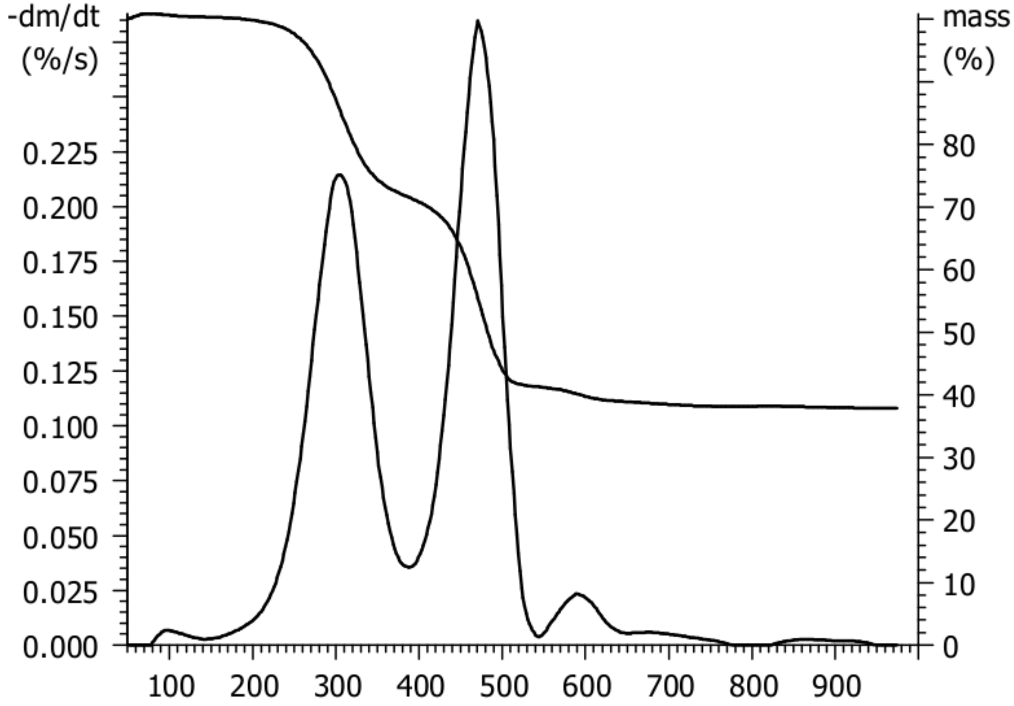
plastic external mesh

3 Pyrolysis
TGA in inert atmosphere



3 Pyrolysis

TGA in inert atmosphere **+ MS and GC**



products of rubber additives (chloralkans, high molecular weight compounds)

products of the main rubber components (butadiene, isoprene, aromatic compounds from polystyrene)

3 Fluidizability of the char particles (powder-like)

Very small particles!

Size distribution measured by laser-diffraction equipment (with ultrasonic treatment)

0.4 ... **40 ... 100** ...200 μm

3 Fluidizability of the char particles
Cold model experiments

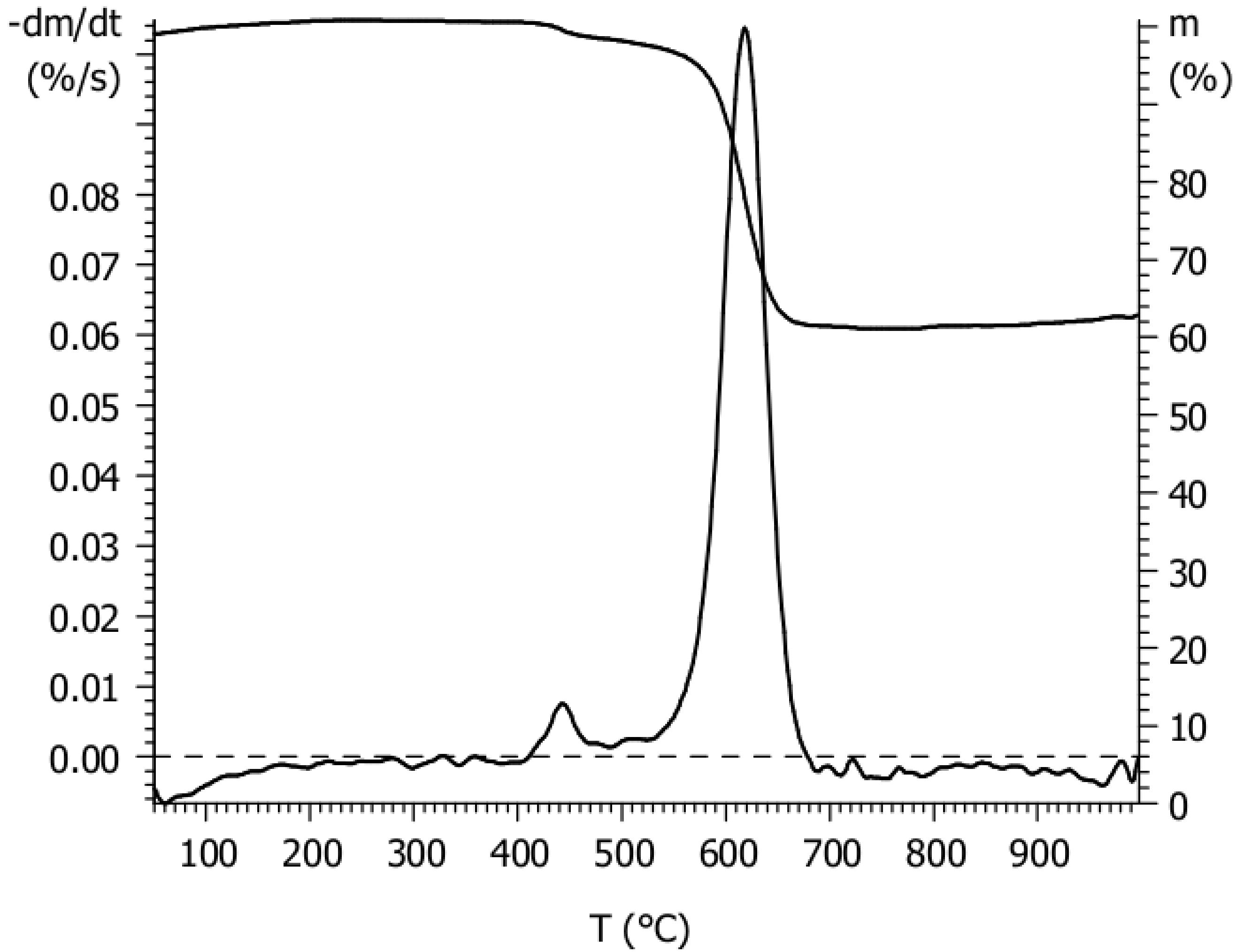
char particles

in the bed **above the bed** ellutriated

(bed material: sand, d_{50} = 250 µm, u_0 = 0.9 m/s)

5 Char combustion

TGA of the char in oxidative atmosphere



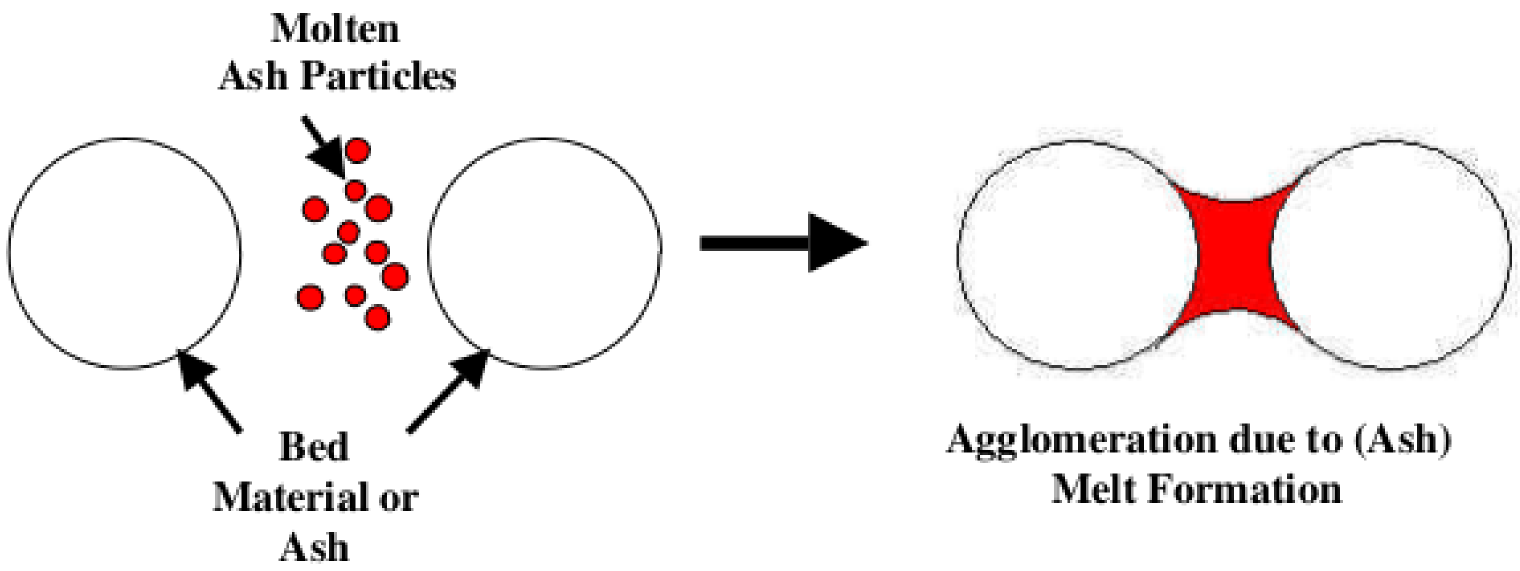
Burnout completed below 700 °C

5 Tendency for bed agglomeration

1st reason

Wisser, 2004

Molten ash due to local temperature peaks



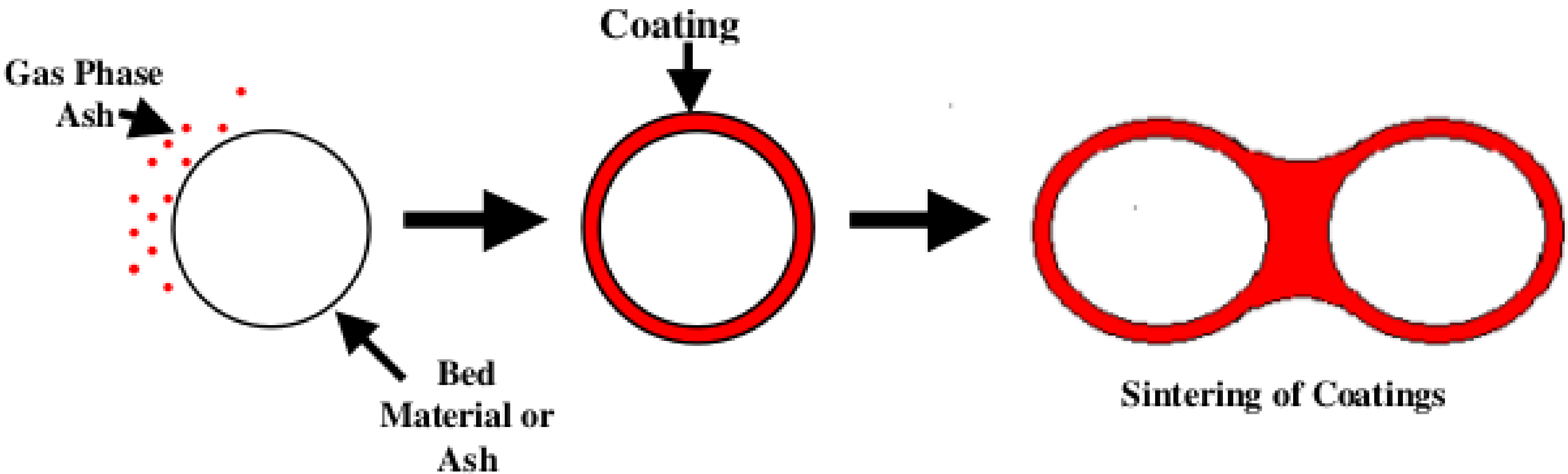
Actual risk:

big particle + high volatile + moderate ash sintering temperature

5 Tendency for bed agglomeration 2nd reason

Wisser, 2004

Sticky sand coating due to gas phase components from the fuel



Actual risk in case of one specific sort of rubber:

$$I1 = \frac{Na+K}{2S+Cl} = 1.5 > 1 \qquad I2 = \frac{K+Na+Si}{Ca+P+Mg} = 4.4 > 1$$

Further steps

Experiments on the FBC facility of BME

Riser
height: 5 m
int. Ø 158 mm

Riser,
Cyclone
int. Ø 219 mm

Standpipe,
Loop-Seal,
Fuel Feed

Further steps
Advices welcome!

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Thank you for your attention!

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