Parameters influencing the mass loss rate in the tube furnace for PMMA

Karen De Lannoye, [a,b], Alexander Belt [a], Ernst-Arndt Reinecke [b] and Lukas Arnold [a,c*]

[a]Institute for Advanced Simulation, Forschungszentrum Jülich, Jülich, Germany
[b]Institute for Energy and Climate, Forschungszentrum Jülich, Jülich, Germany
[c]Computational Civil Engineering, University of Wuppertal, Wuppertal, Germany
[*] Corresponding author: l.arnold@fz-juelich.de / arnold@uni-wuppertal.de

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Abstract

Classically, the tube furnace as described in ISO 19700 is used for toxicity tests. In this set-up a sample is inserted into a tubular oven at a predefined speed in order to get steady state burning. With this set-up, it is also possible to pre-heat the furnace and insert the sample at a certain temperature or to insert the sample in the furnace at the beginning of a test and perform experiments at a defined heating rate. The advantage of this set-up is that it allows for gram scale pyrolysis or burning test under well-defined boundary conditions, compared to other existing gram scale experiments like the cone calorimeter where a.o. the flow velocities around the sample are not well characterised. The tube furnace used in this study is equipped with an online mass loss measurement: a seesaw mechanism allows to determine the mass loss at the centre of mass of the sample. A schematic picture of the set-up can be found in figure 1. Additionally, CO, CO_2 production rates, O_2 consumption rates and sample temperatures can be measured.

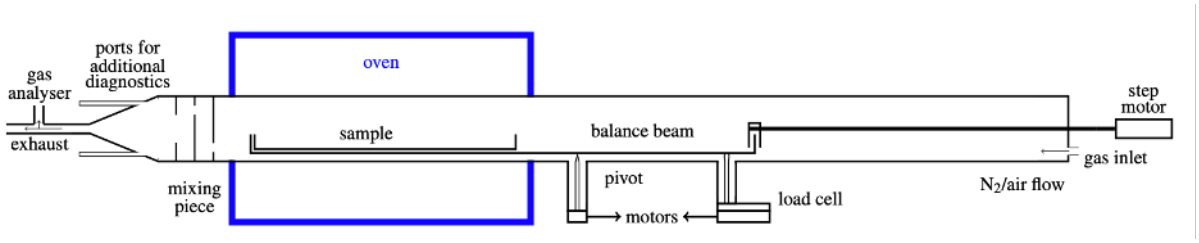

Fig. 1: Schematic view of the tube furnace with online mass-loss measurement.

A first elaborate experimental campaign in the tube furnace, to study the mass loss rate, will be conducted with polymethyl methacrylate (PMMA). For this purpose, cast black PMMA from Evonik (productcode: 9H01) is chosen. It is known that the atmosphere has a ~~big~~ influence on the mass loss rate measured in the TGA [1]. The experiments in the tube furnace ~~will~~ examine whether this effect ~~Is~~ also present for larger scale samples. Additionally, the effect of heat and mass transfer ~~will be~~ studied by varying the heating rate as well as the sample mass. Up to 4 different masses ~~will be~~ studied by varying the thickness of the sample from ~~6mm~~ to ~~20mm.~~ The results of this study will be presented in this contribution.

References

[1] Fateh, T., et. al. Experimental and modelling studies on the kinetics and mechanisms of thermal degradation of polymethyl methacrylate in nitrogen and air. Journal of analytical and applied pyrolysis, 120:423-433, 2016.