Fachbereich 4
Produktionstechnik
Maschinenbau &
Verfahrenstechnik

CENTER OF
APPLIED SPACE TECHNOLOGY
AND MICROGRAVITY

Fluid Dynamics Seminar

Date: Wednesday, November, 1, 2017 at 13:00
Location: ZARM, Room 1730

Modelling the burning of structured PMMA surfaces

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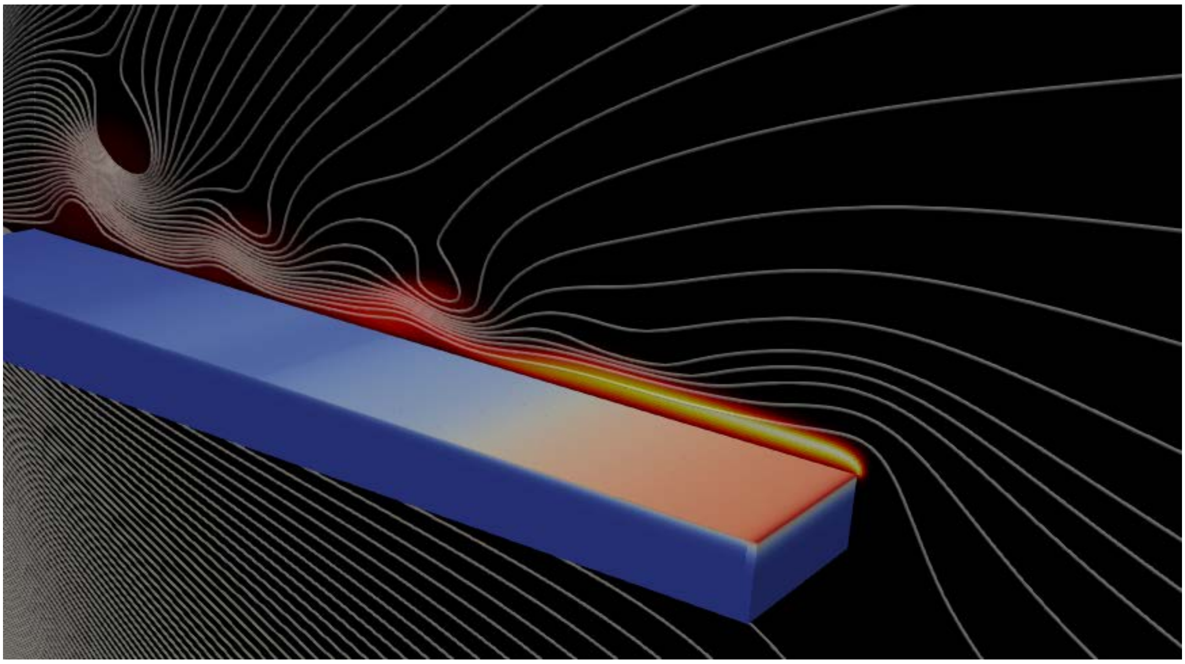

Despite of the high risk caused by the possibility of open fires in manned space flight, only few fire safety experiments are available in microgravity, where flame spread differs significantly from terrestrial conditions. In the absence of buoyant forces, the only mechanisms to mix fuel and oxidizer are molecular diffusion and possibly forced convection, resulting in lower flame temperature and slower propagation.
Because of the difficulties when experimenting with realistic fire scenarios under microgravity, the NASA "Upward flame propagation" test defines a procedure to qualify “fire-safe” materials by evaluating flat plates burning under 1g. However, such qualification cannot be translated to samples of different shapes or in reduced gravity without a better understanding of the interacting processes.

First, I give a short overview of previous works, mostly by students at ZARM, interpreting the flame spread over structured PMMA (acrylic glass) samples in the laboratory, or in reduced gravity within the UB-FIRE REXUS project. I then present the status of a numerical model for the coupled processes of solid PMMA pyrolysing into gaseous C5H8O2, which reacts with ambient air and accelerates the PMMA decomposition through the heat of combustion. After validation with 1g combustion experiments, this model is planned to predict flame spread over structured surfaces with forced oxidizer flow on a TEXUS flight within the TOPOFLAME project.