Fluids and Space Engineering Seminar

Date: Thursday, April 13, 2023 at 14:15 h
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Opposed flame spread on thin PMMA samples at varied oxygen concentrations and pressure conditions

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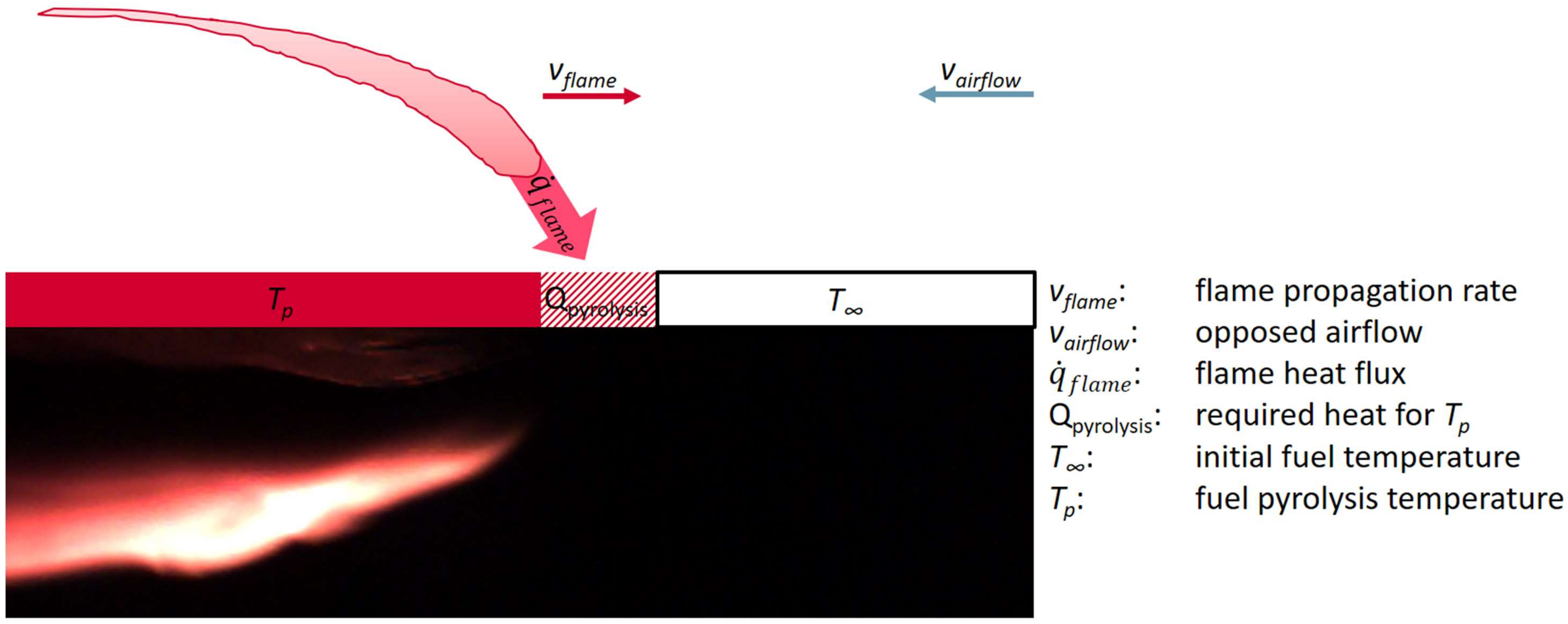

In fire safety research in human spaceflight, the investigation of flame propagation over PMMA samples plays a major role for fundamental research. An important experiment is the study of flame propagation against a forced flow which is called opposed flow propagation when performed under microgravity conditions. Flame propagation is largely determined by the ambient conditions. Of these environmental conditions, those that play a role in exploration missions are particularly interesting. Since there are plans to significantly reduce the pressure in upcoming exploration missions in order to save mass, a corresponding increase in the oxygen concentration will be necessary to maintain the partial pressure of oxygen required for humans. This leads to environmental conditions that have not yet been investigated. The influence of pressure and oxygen concentration on flame propagation is the subject of intensive research and is not yet fully understood. In particular, the influence of ambient pressure has rarely been investigated.

Thin PMMA samples were investigated in microgravity under opposed-flow conditions and varied pressure and oxygen environments. The pressure was varied from 600 mbar to 1013 mbar, the oxygen concentration from 21% to 35.4%. Based on the widely used analytical model by De-Ris, a theory was developed to illustrate the influence of pressure and oxygen on flame propagation. This theory was then compared with the measurement results.

This talk will show how oxygen concentration and ambient pressure affect flame propagation. In addition, the effect of reduced inflow velocity will be considered. The results will then be related to their relevance for future exploration missions.