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特集：燃焼～単純化して探る複雑現象
(原著論文)

# 熱的に薄い固体試料上を伝播する火炎のスケール解析

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# Scale Analysis of Flame Spread over a Thermally Thin Material

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**Abstract**

The flame spread over a thin PMMA film is measured in microgravity condition with varying the ambient flow velocity, the diluent gas, the ambient pressure and the sample width. In order to find out the impact of these factors, we build up a simple flame scheme with a scale analysis. We set the oxygen level at 30%, and use $N_2$, $CO_2$, Ar, and He as a diluent gas. The ambient flow is varied from 0 cm/s to 28 cm/s. The result shows that the flame spread near a quiescent condition is suppressed due to mainly two heat losses; one is a radiative loss and the other is a conductive heat loss sideward. The scale analysis is very helpful to decouple these effects and it is found that the radiative loss is dominant in $N_2$–$O_2$ or Ar–$O_2$ condition, and the side loss is dominant in He–$O_2$ condition. Reducing ambient pressure and/or sample width increases the side loss significantly and causes extinction especially in He–$O_2$ condition. In $CO_2$–$O_2$ condition, both the radiative loss and the side loss are small even with very low ambient flow, that leads robust flame near a quiescent condition in microgravity.