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A + B -> C RADIAL REACTION FRONTS IN MICROGRAVITY

Abstract

Reaction-Diffusion-Advection (RDA) fronts have always been of great interest because of the wide variety of applications they find, such as in CO_2 sequestration or soil remediation. The dynamics of an A + B $\rightarrow$ C reaction front in radial geometry have previously been studied both analytically and numerically. Nevertheless, experiments on Earth are significantly influenced by buoyant effects, hindering the comparison with theoretical models. We conducted microgravity reaction front experiments in Hele-Shaw cells with radial symmetry aboard the TEXUS-57 mission sounding rocket. We employed a reaction with a coloured product and we obtained quantitative data about the reaction fronts under microgravity such as the total amount of product, n_C and the reaction front width, W_C. Experiments showed that gravity significantly affects experiments on ground leading to higher product generation and wider front widths, and that the effect of dispersion cannot be ignored for modelling purposes. The temporal trends of the above metrics are also distorted by buoyant effects. By eliminating the buoyancy effects in the sounding rocket flight, we were able to directly compare the experimental data with theoretical models and numerical simulations.