

[PO-E2]Poster Session 2

Symposium E

Wed. Oct 31, 2018 5:45 PM - 8:00 PM Poster Hall

[P2-34]Dynamics of a solidification front made by invasion of fluid with a different temperature

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When fluid flows into another hotter or colder fluid, solidification often occurs in narrow regions at the vicinity of the interface. Such interfaces exhibit peculiar patterns in the growth process because of accompanying solidification fronts. Similar phenomena are observed in soft membranes created by chemical reactions of two fluid, as reported by H.~Wagatsuma et al.(Physical Review E, 2017). In geological scales, we could also see examples of such phenomena in pillow lava and growth of a volcanic island.

We carried out experiments by pouring ice-cold water into paraffin melt in a Hele-Shaw cell and found that solidification of paraffin causes fingering patterns with large meandering. The melting temperature of paraffin we used is about 56-58 degrees C, but the rheological measurements indicated that paraffin behaves as a soft viscoelastic material under the temperature. We infer that precipitous increase of the viscosity of paraffin is mainly responsible for large meandering of fingering growth.

A simple two-dimensional mathematical model is considered to find an interface dynamics in such phenomena theoretically. Although a standard method of the center-manifold reduction can not be used for solidification fronts growing in time, we develop a similar systematic method to derive the equations of interface motion.