Abstract Submitted
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Analysis of Thermo-Diffusive Cellular Instabilities in Continuum Combustion Fronts[1] HOSSEIN AZIZI, SEBASTIAN GUREVICH, NIKOLAS PROVATAS, McGill university, DEPARTMENT OF PHYSICS, CENTRE FOR THE PHYSICS OF MATERIALS TEAM — We explore numerically the morphological patterns of thermo-diffusive instabilities in combustion fronts with a continuum solid fuel source, within a range of Lewis numbers, focusing on the cellular regime. Cellular and dendritic instabilities are found at low Lewis numbers. These are studied using a dynamic adaptive mesh refinement technique that allows very large computational domains, thus allowing us to reduce finite size effects that can affect or even preclude the emergence of these patterns. The distinct types of dynamics found in the vicinity of the critical Lewis number. These types of dynamics are classified as "quasi-linear" and characterized by low amplitude cells that may be strongly affected by the mode selection mechanism and growth prescribed by the linear theory. Below this range of Lewis number, highly non-linear effects become prominent and large amplitude, complex cellular and *seaweed* dendritic morphologies emerge. The cellular patterns simulated in this work are similar to those observed in experiments of flame propagation over a bed of nano-aluminum powder burning with a counter-flowing oxidizer conducted by Malchi et a*l*. It is noteworthy that the physical dimension of our computational domain is roughly close to their experimental setup.

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