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Convective combustion in porous media: singular limit of high activation energy

We consider a system of degenerate reaction diffusion equations which describes a convective (pressure driven) regime of combustion in porous media. The goal is to study the behavior of this system in the limit of high activation energy. We show that the limit solution for this problem in arbitrary spatial dimension solves a parabolic equation with memory term similar to one arising in solid combustion. Moreover, under the additional assumption of the solution being time increasing, we prove that the limit problem coincides with Stefan problem for supercooled water with spatially inhomogeneous coefficients. We also obtain the precise limit problem for (not necessarily planar) traveling waves in any dimension.

This is a joint work with Peter Gordon (New Jersey Institute of Technology).