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**Dead-core solutions for slightly non-isothermal diffusion-reaction problems with power-law kinetics.** (English) [Zbl 07203966](#)

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**Summary:** The paper deals with dead-core solutions to a non-isothermal reaction-diffusion problem with power-law kinetics for a single reaction that takes place in a catalyst pellet along with mass and heat transfer from the bulk phase to the outer pellet surface. The model boundary value problem for two coupled non-linear diffusion-reaction equations is solved using the semi-analytical method. The exact solutions are established under the assumption of a small temperature gradient in the pellet. The nonlinear algebraic expressions are derived for the critical Thiele modulus, dead-zone length, reactant concentration, and temperature profiles in catalyst pellets of planar geometry. The effects of the reaction order, Arrhenius number, energy generation function, Thiele modulus, and Biot numbers are investigated on the concentration and temperature profiles, dead-zone length, and critical Thiele modulus.

**MSC:**

80 Classical thermodynamics, heat transfer

35 Partial differential equations

**Keywords:**

diffusion and reaction; non-isothermal reaction; catalytic Pellet; power-law kinetics; dead zone; semi-analytical solutions

**Software:**

HYBRJ; IPython; minpack; SciPy

**Full Text:** [DOI](#)

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