

*Dead-core formation in catalytic reaction and diffusion
processes with generalized diffusion flux*

Piotr Skrzypacz

**(Department of Mathematics, School of Sciences and Humanities,
Nazarbayev University)**

Bek Kabduali, Alua Kadyrbek, Sławomir Szafert, Vsevolod Andreev, Boris
Golman

Dead-core and non-dead-core solutions to the nonlinear diffusion-reaction equation based on the generalized diffusion flux with gradient-dependent diffusivity and the power-law reaction kinetics in catalyst slabs are established. The formation of dead zones, i.e., zones with vanishing reactant concentration, is characterized by the critical Thiele modulus that is derived as a function of reaction order and diffusion exponent in the generalized diffusion flux. The effects of reaction order and diffusion exponent on the reactant concentration distribution in the slab and dead-zone length are analyzed. It is particularly demonstrated that by contrast to the model based on the standard Fickian diffusion, dead-zone can exist in the case of first-order reactions. Also, the relationship between critical Thiele moduli for models based on the generalized and standard Fickian diffusion fluxes is established.