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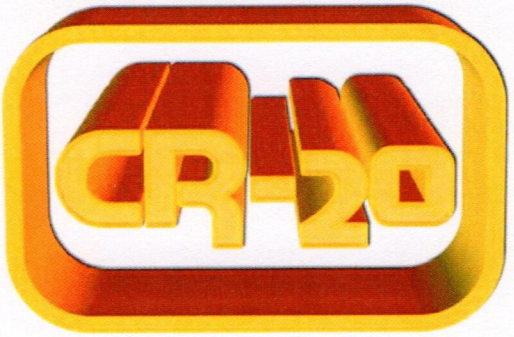

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ABSTRACTS

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MATHEMATICAL SIMULATION OF A FLUIDIZED BED CATALYST IN THE ISOBUTANE DEHYDROGENATION REACTOR

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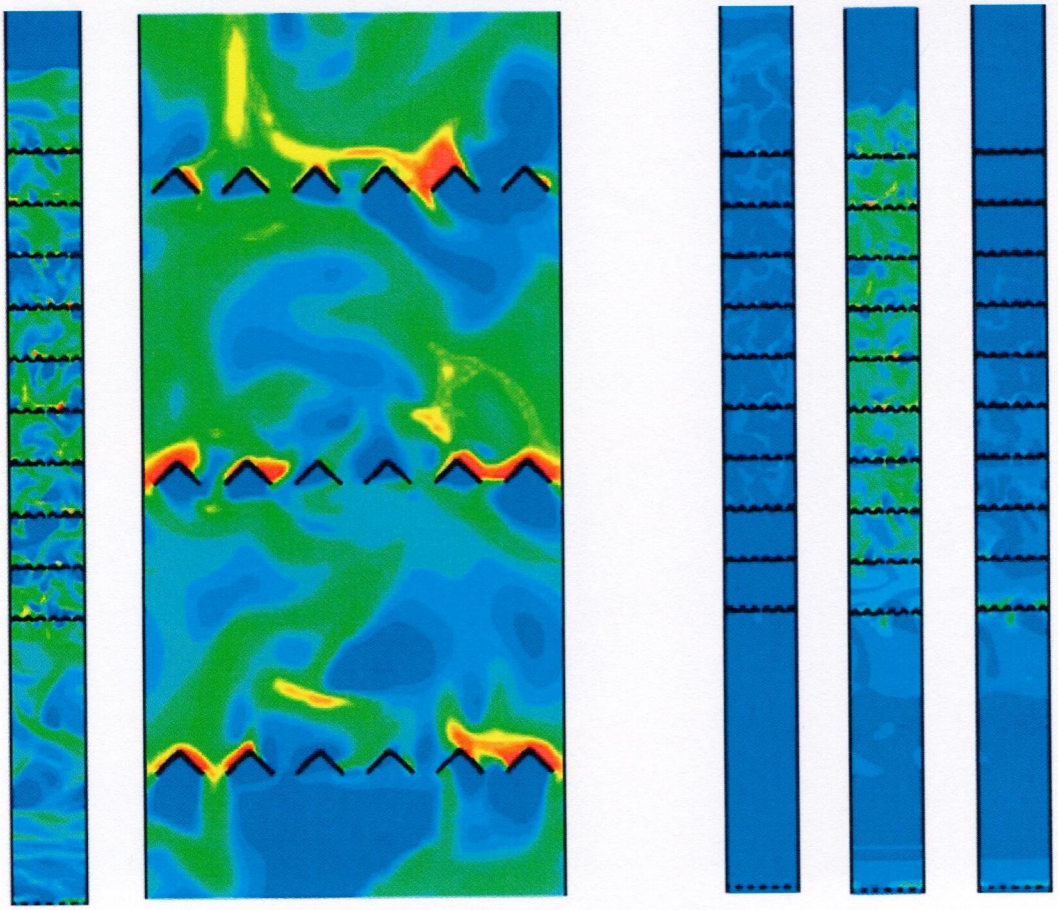
In order to optimize the operation of the isobutane dehydrogenation reactor with a fluidized bed of chromia-alumina catalyst, in particular for the organization of a uniform distribution of catalyst in the cross section and height of the reactor, reducing the entrainment of fine particles, to maintain the necessary level of catalyst, mathematical simulation of a fluidized bed was carried out. It was investigated the motion of solid catalyst particles with a size of 20-200 microns in isobutane dehydrogenation reactor of JSC "Nizhnekamskneftekhim", which had an internal diameter of 5.1 m and 17.4 m in height, was partitioned by ten distributive lattice of angle-type with an area of free section of 30%.

A calculation was performed for the periodic two-dimensional flow reactor section which is 0.432 m in width with six sections of the distributive lattice. A simulation was carried out for the following boundary conditions: the right and left borders are periodic, velocity-inlet condition for the gas and impermeability condition for the catalyst at the bottom of the reactor. Simulation of multiphase flow was carried out by using Eulerian-Eulerian approach.

Figure 1a shows a calculated the catalyst concentration field with a particle size of 100 microns in diameter at a fixed time. At the entrance of the reactor large rarefied zones were formed. Between the lattices the average concentration of the solid phase was equalized, and the zones with catalyst accumulation at the lattices are observed. Calculations showed that at any given time approximately two thirds of the lattice is locked to by the catalyst that falls down. Through the rest of the free cross section the gas bubbles go up.



a b

Figure 1. The distribution of the catalyst in the cross section of the model reactor

Figure 1b shows the distribution of catalyst with the particle size of 50, 100 and 150 microns in diameter. Particles with a size of 50 microns (left) are entrained by gas flow in the upper part of the reactor. Particles of intermediate size (center) is uniformly distributed in the reactor between the lattices. Large particles (right) are concentrated mainly near the first lattice.

Based on these results a mathematical model was developed which allows to predict the behavior of polydisperse catalyst bed.