Physico-chemical nanomaterials science

Phase composition and nanoporous structure of core and surface in modified granules of NH_4NO_3

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Analysis of studies series [1-4] has shown, that the porous surface layer on ammonium nitrate granules producing process with high efficiency can be carried out in granulators of vortex type with variable in height cross sectional area. Granulators of vortex type due to their versatility, high specific productivity and environmental safety allow to obtain granules of porous structure with normative levels of quality with relatively low energy costs (as compared with other devices with fluidized bed) and the low concentrations of harmful substances in the exhaust heat transfer agent [5]. It should be noted, that the main characteristics of vortex granulators application in obtaining porous ammonium nitrate (PAN) is adequately reflected in studies [1, 6-9], where it was studied hydrodynamic and thermodynamic conditions of porous surface layer obtaining, energy and environmental characteristics of this process. The results of computer simulation of the hydrodynamic conditions of single-phase and two-phase flows motion in the vortex granulator workspace [10, 11] have also confirmed the effectiveness of this type of devices. Additional interest deals with the detailed study of granules structure (geometrical parameters, pores structure and their depth etc.), also the question of determination the phase composition and crystal structure after humidification PAN granules and heat treatment remains open.

Diffractometry results of studied samples has shown, that the phase composition of samples is not affected of humidification with any type of solution, and heat treatment. The crystal structure of granules after the humidification and heat treatment has some changes due to increasing the number of pores. The changing of crystal structure, in turn, allows to open access to nanopores, which are located in the volume of granules. This allows to increase the holding capacity indicator of granules. An important result of conducted researches is the establishment the fact of oxygen molecules "integration" to the crystal lattice of ammonium nitrate, that have positive impact on the industrial explosives

detonation velocity.

Results of samples electron microscopy has shown, that after the heat treatment and humidification developed porous surface layer is formed on the granules, that consists mainly of nanoscale pores and small amount of micropores. Such surface structure is optimal from the standpoint of the diesel fuel distillate absorption at early stage of industrial explosive preparation and the distillate holding at granules transportation stage.

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