

Methods for controlling the properties of nanoporous layers in granules of porous ammonium nitrate: stage of drying

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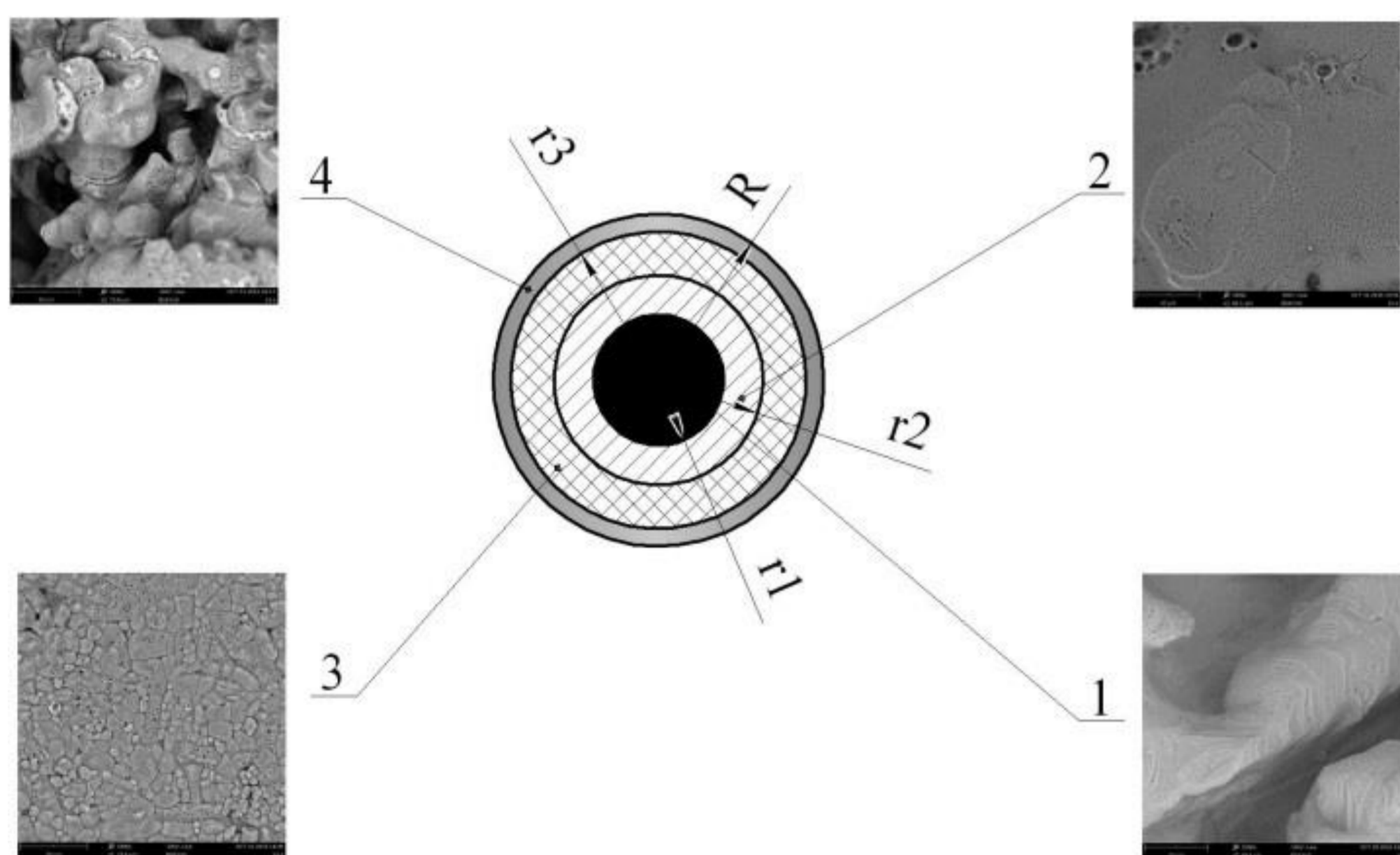
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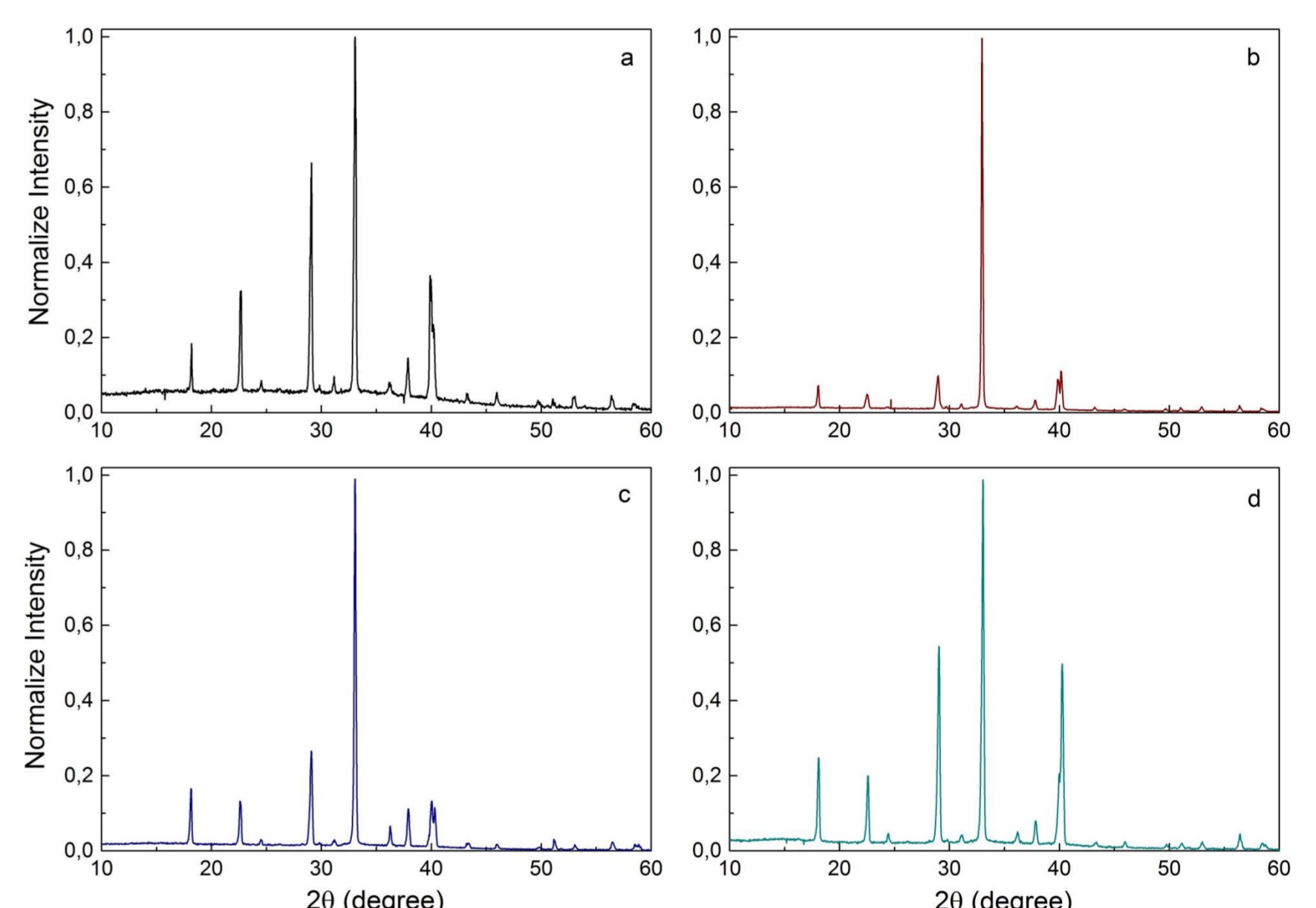
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Abstract - this work is devoted to the search for methods of controlling the formation of the nanoporous structure of ammonium nitrate granules (as a component of the industrial explosive of ANFO) during the dehydration stage. The influence of the design of multistage dryer's each stage on the features of a nanoporous layer formation process is shown. The length of the shelf contact, its angle of inclination, and the degree of perforation affect the residence time of the granules in the dryer (the formation time of the nanoporous layer after wetting with a solution).

Keywords - 3D Nanostructured Porous layer, Vortex granulator, Moisturizing



Structure of the porous ammonium nitrate granule: 1 – core; 2 – inner layers; 3 – central layers; 4 – outer layers (surface); R – radius of the granule; r – current radius of the granule



Diffractograms from the ammonium nitrate granules: a – an initial granule; b – granule after humidification with water and thermal treatment; c – granule after humidification with urea solution and thermal treatment; d – granule after humidification with ammonium nitrate solution and thermal treatment

The influence of humidifier type on granules quality

Type of humidifier	Strength, kg / granule	Absorption capacity, %	Holding capacity, %
Water	0,4	8,3	9,6
Solution of ammonium nitrate	0,4	8,4	10,1
Solution of ammonium nitrate and carbamide	0,4	8,5	11
Solution of ammonium nitrate, carbamide and lauryl sulfate sodium	0,42	8,5	11,4

Conclusions

Analysis of experiments results has shown, that various types of humidifiers can form various kinds of pores after drying according to the classification:

- cracks, chips, cavities - "mechanical" pores;
- channels of various shapes - "modification" pores (micro, meso- and macro-pores).

Some of these pores were formed as a result of thermal stresses and inadequate core strength of initial granule («mechanical» pores), some – directly into granules during the drying process after humidification («modification» pores). Various types of humidifiers also have significant effect on the ratio of values of «mechanical» and «modification» pores.

The obtained results allow to select the optimal humidifier composition, which promotes the formation of significant amount of macropores on surface and mesopores of near-surface areas.