These changes in the characteristics of the electric signal indicate the formation in samples of internal defects (e.g. because there are no external defects), the appearance of which can be monitored.

Further research will be focused on the adaptation and improvement of the previously proposed algorithms and methods of NDT method based on the Phenomenon of Mechanoelectric Transformations in heterogeneous non-metallic materials for testing glass fiber reinforced concrete.

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EFFECT OF MECHANICAL MILLING IN THE PRODUCTION OF COMPOSITE CERAMICS

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Production of ceramic composite is carried out by various technologies. An important part of the production ceramic is mixing and milling of initial reagents. In this paper the role of mechanical milling in the production of ceramics is considered.

The advantages of the mechanical milling methods are:

- simplicity of installations and technologies;
- mixing of the initial powders;
- milling of various materials.

Disadvantages of the method include:

- contamination of the milling powder with abrading materials;

- difficulty of obtaining powders with a narrow particle size distribution;
- difficulty of regulating the composition of the product during the grinding process.

Milling implies impact, shearing and grinding performed by the so-called milling bodies, walls of the milling devices and the mass to be milled. When milling, the solids undergo elastic and plastic deformation which results in origination and accumulation of microcracks leading to formation of new interfaces and destruction of the bodies. Fragile non-plastic materials (silicon, manganese, various heat-proof compounds) are easily milled. Plastic metals (copper, zinc) are materials which much worse undergo milling. While milling, they can flatten and agglomerate.

The simplest device used to produce powders is a ball mill, which is a metal cylindrical drum, with milling bodies inside, which are typically steel or tungsten carbide balls, and the material to be milled. When the drum rotates at different speed, the balls move in different motion mode and, therefore, several modes of grinding.

At low rotation speed of the drum, the balls are sliding to the surface of the rotating drum. In this case, the material abrades between the outer surface of the ball mass and the wall of the drum. The efficiency of milling is low. This mode is often used for mixing of dissimilar materials.

When the number of drum rotations increases, the balls rise to a definite height with the rotating drum wall due to friction with the wall of the balls, and then roll down the inclined surface of the ball mass. In this case the material is milled between the surfaces of the sliding balls. The intensity of the material abrasion increases.

With a greater number of rotations, the balls rise to a considerable height and fall down producing a crushing action that amplifies an abrading effect on the material. This position is the most intense milling mode. With further increase in rotation of the drum, the centrifugal force increases, and the balls rotate together with the drum. The material ceases to be crushed.

Experimental

The tested powder was milled in SPEX 8000M planetary ball mill using tungsten carbide balls. The duration of the milling was 30, 60 and 120 minutes. After each stage of milling, the particle size was analyzed with Fritsch analyzer by laser diffraction.

Results and discussion

The characteristics of particle size distributions by laser diffraction method are summarized in Table 1.

Table 1. Particle size distribution

Sample	D_{10}, μm	D_{50}, μm	D_{90}, μm
Initial sample	1.28±0.02	1.95±0.02	3.00±0.10
Milled for 30 min	1.13±0.09	1.80±0.06	2.88±0.04
Milled for 60 min	1.00±0.01	1.54±0.05	2.38±0.18
Milled for 120 min	1.90±0.05	1.32±0.02	1.91±0.03

Fig. 1 shows differential and integral particle size distribution.

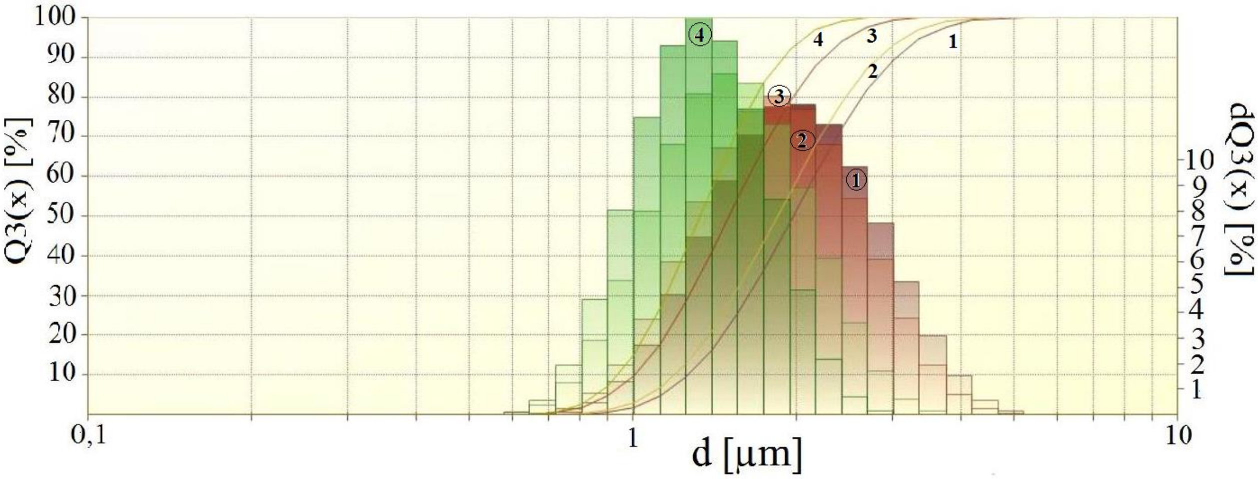

Fig. 1. Differential and integral particle size distribution: 1is for non-milled sample; 2 is for sample milled for 30 min; 3 is for sample milled for 60 min; and 4 is for sample milled for 120 min.

As can be seen in Fig. 1, mechanical activation of lithium ferrite powder leads to a slight reduction in particle size and higher powder homogenization. Thus, to obtain a homogeneous composition of the lithium ferrite powder, the time of mechanical treatment should be at least 2 hours.

Conclusions

In [1–2], mechanical activation of the initial reactants is shown to greatly increase its reactivity, and allows obtaining lithium ferrites at significantly lower temperatures as compared with those obtained by the conventional method.

The results showed that mechanical activation of lithium ferrite powder in air at room temperature causes slight reduction of the particle size and increases the homogeneity of the ferrite powder. For visible effect the duration of mechanical milling should be 2 hours.

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EVALUATION OF THE MODULATION TRANSFER FUNCTION OF A HIGH ENERGY X-RAY TOMOGRAPH

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Abstract

The modulation transfer function of a high energy computed tomography scanner is studied experimentally using the steel ball to estimate the performance of the system. The modulation transfer function is calculated from the edge response function in different planes in space. The modulation transfer function value is evaluated by the software designed in Matlab.

Introduction

X-ray Computed Tomography (CT) is a non-invasive technique for imaging the internal structure of solid objects and for obtaining digital information on their 3-D geometries and properties. X-ray CT is useful for a wide range of materials, such as rock, bone, ceramic, metal and soft tissue.

The modulation transfer function (MTF), which is calculated from the edge response function, is the established method of characterizing the spatial response of an imaging system. To obtain the edge response function (ERF), there are several techniques, including using a fine wire, narrow slits or an edge phantom. However, the industrial CT system was designed to explore high dense materials and it provides relatively noisy images. In addition, special software was developed to calculate the ERF, the line-spread function (LSF) and the MTF [2].

The goal of this paper is to investigate the possibility of evaluating the MTF of a high-energy CT scanner. The MTF is studied to provide precise and reliable data of spatial resolution in ZX, YZ, XY planes.

Method

Spatial resolution for the cone beam CT system is measured with the beam hardening correction according to the standard ASTM E1695-95[1]. The steel ball with the size of 33.3 mm in diameter is used as a test phantom. The ball is placed in the field of view of the CT system, and it is situated in the center of the rotation stage. 3D CT images with the beam hardening