	75,6	762,3	901,6

Conclusion. The obtained values of the critical strain power density W_{cr}* for the investigated specimens are in a good agreement with the results of experiments that establish the dependence of the cavitation-erosion resistance of technical ceramics on the content of aluminum oxide. The introduction of the modifier of ZrO_2 into the α-Al_2O_3 ceramic matrix allows the significant increasing of its wear resistance. Wear of materials is determined by the intensity of the cavitation effect and the phase ratio of components. The mechanism of wear of ceramics has a cyclical nature, which is similar to hydro-abrasive wear of metals. To assess the wear of ceramics it is possible to use the approach similar to that one used for the assessment of wear of metals. The using of modified ceramics is recommended for elements of food equipment that are operated under cavitation and waterjet wearing conditions. The chemical ceramics inertness is useful for working in aggressive technological environments of food industry.

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MODELING OF THE MIXING PROCESS

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The kneading of wheat yeast dough by cam working elements is investigated. Mathematical modeling was performed using the Flow Vision software package based on the simulation of three-dimensional motion of liquids and gases in technical structures, as well as for the visualization of flow curves by computer graphics. Physical modeling was performed via experimental setup with cam kneading elements. The distance between the cams is 2–4–6–8–10 mm, the rotation speed is 20–100 rpm.

Keywords: mathematical, modeling, dough, kneading, cam

Introduction. Imitation modeling aims to calculate the values of certain characteristics of a process that develop over time, by reproducing the flow of this process on a computer via its mathematical model [1-2]. During projecting of the process of dough mixing, there is a range of issues related to the type of working elements is supposed to be chosen. On the basis of theoretical searches and obtained experimental results, after comparative analysis of working elements, it was decided to simulate the process of kneading yeast wheat dough using cam working elements [3-4].

Dough kneading is a complex process that involves creating a homogeneous capillary-porous mass of flour, water, yeast, salt, and other components. The formation of dough during kneading occurs as a result of a number of processes, of which the most important are: physico-mechanical, colloidal and biochemical processes [5-6].

Main part. Mathematical modeling of the yeast dough kneading process was performed via the Flow Vision software package, which is designed to model the three-dimensional motion of liquids and gases in technical and natural objects, as well as to visualize flow curves by computer graphics.

Based on the results, after parametric modeling of the kneading process by the cam working elements, a linear dependence of the speed of movement of the dough in the working chamber was obtained (Fig. 1).

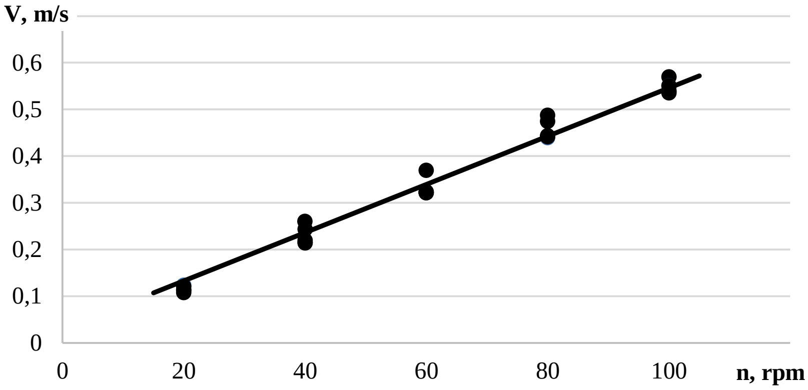

Fig. 1. Variation of mixing speed, depending on the distance between the cams and the speed of rotation of the working element.

It has been investigated that with increasing the speed of the working element, the speed of movement of the dough in the mixing chamber increases, under these conditions of the mixing process the distance between the cam working elements does not affect the speed of mixing.

This result is explained by the fact that the cam working elements rotate to meet each other, the highest pressure is observed in the area of engagement of the cam working elements and in the area of contact with the wall of the housing.

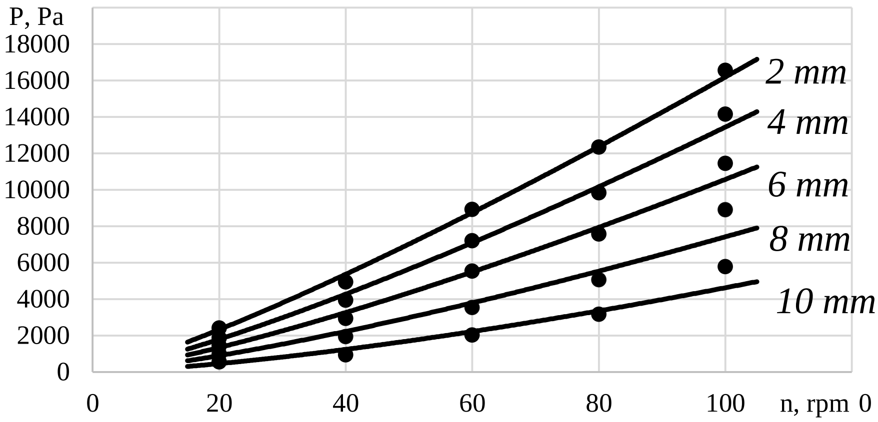

Fig. 2. Changing the pressure in the mixing chamber, depending on the distance between the cams and the speed of rotation of the working element.

The change in pressure [P = PA] in the mixing chamber, depending on the distance between the cams and the speed of rotation of the working element is of a power character and is described by the formula:

$$P = (73 - 6{,}9S)n^{0{,}03S + 1{,}14}, \qquad (1)$$

where, S – is the distance between the cam working elements, mm; n is the speed of rotation of the working element, rpm.

This result is explained by the fact that with increasing speed of the working elements decreases the viscosity of the yeast dough, and the change in viscosity is affected by the distance between the cam working elements in the process of kneading the dough.

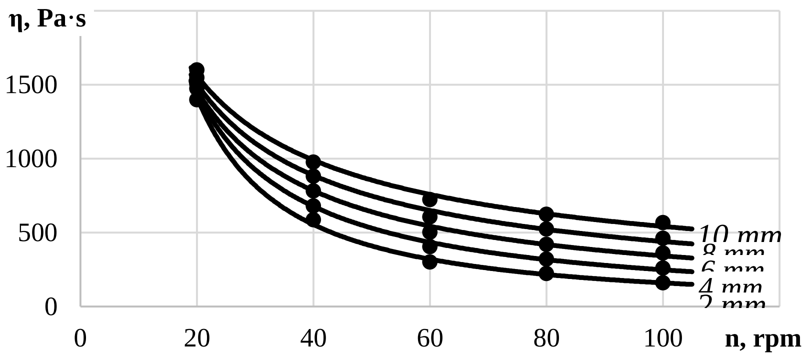

Fig. 3. The viscosity change in the kneading chamber, depending on the distance between the cams and the rotation speed of the working element.

It has been investigated that with increasing rotation speed, the viscosity of the dough [η = Pa · s] decreases in the kneading chamber. The decrease in viscosity is also affected by the reduction of the distance between the cam working elements, as the distance between the cams during the kneading process will decrease the viscosity of the dough.

The mathematically obtained dependence is described as:

$$\eta = (201431 \cdot S^{-1,4}) n^{0,09S - 1,4}, \quad (2)$$

where, S – is the distance between the cam working elements, mm; n is the speed of rotation of the working element, rpm.

Conclusions. The simulated parametric model of the kneading process by cam working elements has been developed that allows to perform design calculations effectively in case rational structural and technological parameters selection. The use of the presented scientific and methodological developments will greatly speed up and economically save the process of creating reliable technological equipment for kneading yeast dough.

Changes in the shear stresses of the yeast dough in the mixing chamber, in the area of engagement of the working elements and close to the contact with the walls of the mixing chamber are studied. The dissipation distribution in the kneading chamber and the temperature change during the kneading process were investigated. At a rotation speed of the working element of 60 rpm, the temperature of the yeast dough rises to 5° C, which is acceptable during kneading of the dough.

Mixing speed, dough viscosity, and mixing chamber pressure were investigated. With increasing rotation speed of the working element, the speed of mixing the dough in the mixing chamber increases. Increasing the rotational speed from 20 rpm to 100 rpm increases the pressure in the kneading chamber and reduces the viscosity of the yeast dough.

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АНАЛИЗ ВЛИЯНИЯ РЕЖИМА РАБОТЫ МАШИНЫ НА ПОТЕРИ В ПРИВОДЕ

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Резюме - был проведен анализ потерь в приводе с учетом режимов роботы машины и методов их уменьшения. Целью анализа был поиск решений по энергосбережению в приводах машин циклического действия. Проанализировано и систематизировано существующие методы сохранения энергии.

Ключевые слова: привод, режимы, работы, энергия, рекуперация.

Введение. Потребности современной промышленности, в условиях ограниченных энергетических ресурсов, принуждают к поиску энергосберегающих решений.

Машины циклического действия нашли широкое применение в упаковочных и транспортных операциях. В последнее время часто используют сервопривод, но наиболее широкое применение удерживают асинхронные электрические двигатели. В этой статье рассмотрим влияние регулировки хода машин на выбор электродвигателя, и как следствие энергетические параметры оборудования.

Основная часть. Возможные режимы работы отличаются огромным многообразием по длительности и характеру циклов, значениям нагрузок, условиям охлаждения, соотношения потерь в период пуска и установившегося движения и тому подобное, поэтому изготовление двигателей для каждого из режимов работы электропривода не имеет практического смысла. На основании реальных режимов в ГОСТ 186-66 предусмотрены восемь режимов работы, для которых проектируются и изготавливаются серийные двигатели.

Рассмотрим режимы работы S1 продолжительный и S6 перемежающийся.