CONSIDERATIONS ON THE SOURCES OF ERRORS IN EXPERIMENTAL COMPRESSION DETERMINATIONS

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Abstract: The compression request of some materials sintered at ambient temperature generally presents a macrostructural quasi-homogeneity and quasi-isotropy and inhomogeneities appear due to the presence of pores in the structure. A separate investigation is done on the sample to highlight the defects in the structure. Therefore, before proceeding to the tests, the operator is obliged to know the nature of the material, the mechanical processing undergone and the thermal treatments undergone. Only following these initial data will the operator choose the appropriate method of submission to the request, so that experimental errors are minimal.

Key words: inhomogeneities, sintered materials, compression, experimental errors.

1. Introduction

The application of various experimental methods of compression leads to the appearance of sources of errors, the knowledge of which is absolutely necessary to obtain viable results.After a prior assurance of the correct and precise operation of the installation, it is necessary to choose the appropriate conditions for the execution of the tests, and in the sources of errors involved, three determining factors can be distinguished:[1]

- inhomogeneity of the sample to be tested,
- errors of the equipment used in the tests,
- operator intervention.

2. The experimental method

The test equipment is a universal compression press with hydraulic drive, which must satisfy the conditions prescribed in the standards and the verification instructions. The placement of the press must be stable to avoid elastic deformations and movement of the device during the tests. Their installation and fixing is done on solid foundations that significantly increase the reproducibility of the determinations, the measurements being obtained with minimal errors.

When placing the sample on the table of the device, it is aimed to fix it centered in order to ensure the uniform deformation of the sample, the stress force should be applied in the center of gravity of the sample. Therefore, before proceeding to the tests, the operator is obliged to know the nature of the material, the mechanical processing undergone and the thermal treatments undergone. Only following these initial data will the operator choose the

appropriate method of submission to the request, so that experimental errors are minimal.[2,3]

Tabelul 1. F/F_{rup} depending on the relative length

FC – 40		FC - 80		FC –50 U3	
D/h	F/F_{rup}	D/h	F/F_{rup}	D/h	F/F_{rup}
1,95	0,21	2,01	0,19	1,82	0,15
2,03	0,28	2,05	0,25	1,95	0,21
2,25	0,29	2,70	0,47	2	0,38
3	0,45	3,37	0,56	2,77	0,47
5.92	1	6	1	5,18	1

The vibrations that appear in the samples as a result of the experimental stress influence the homogeneity of the structure, and for metallic steel powders in the compression tests, it is necessary to use two test frequencies, because even with similar porosities the properties can be different, at different frequencies:[5,6,7,8]

- breaking limit is 10^9 cycles;
- in appearance, the breaking surface is similar to that of many tested materials, however changes occur due to the initial breaking of the pores and then of the metal matrix.

Description of test parameters in figure 1 for FC 40.

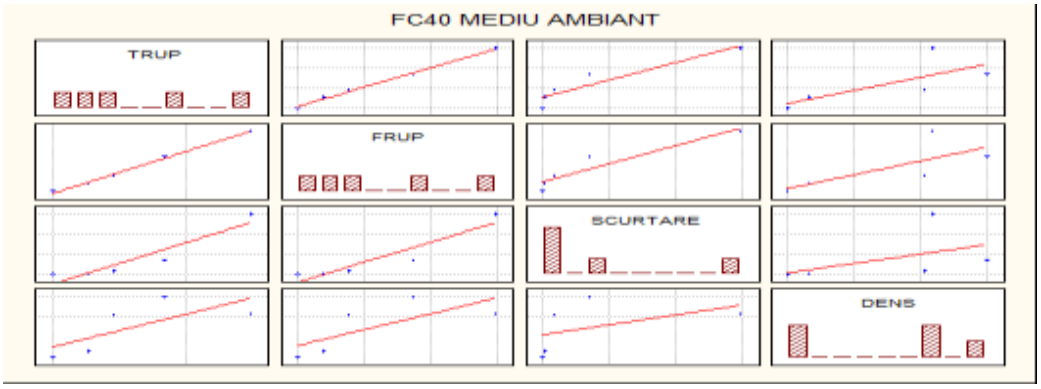

Figure 1. Parameters FC 40.

Description of test parameters in figure 2 for FC 50U3.

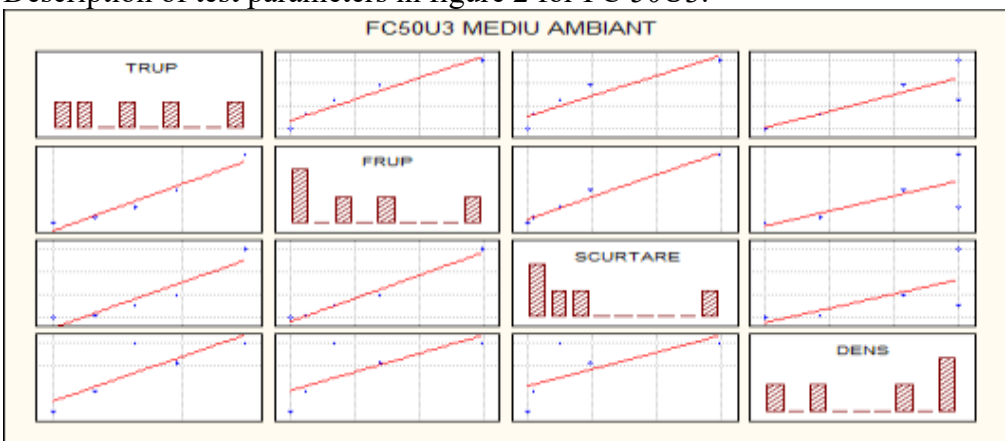

Figure 2. Parameters FC 50U3.

The analysis of the process factors highlights the fact that the shortening of the material depends on the temperature at which the test is carried out, the behavior of the material being better in the ambient environment for the material containing copper.

Thus the deformation of the material is directly proportional to the load applied during the test. The deformation of the material is not influenced by the action time of the deformation load on the specimen subjected to stress.

The retention time depends only on the test temperature, having different values compared to the corresponding values in the ambient environment. This also results from the variation of F/Frup depending on the relative length, figure 2.

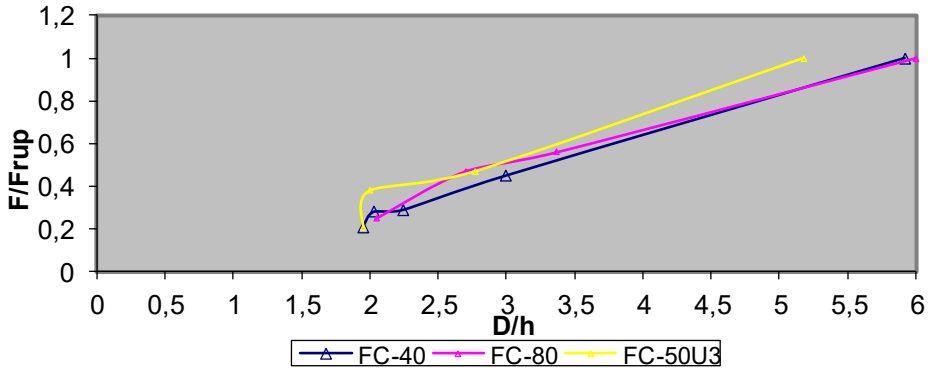

Figure 3. The variation of F/Frup depending on the relative length

From the test diagram it follows that the compression test is produced by changing the volume, due to the porosity, the volume is variable from one sample to another, which does not happen in the case of compact materials.

In the case of sintered materials, the deformation occurs at the level of the bridges between the particles and the pores, causing the porous structure to be crushed and the pores to break.

3. Conclusions

The loading of the loads prescribed by the standards is applied slowly and without shocks, being maintained for a duration necessary to reach the deformation. The pairs of values obtained during the test are read.

Within the methods of mathematical statistics, the agreement between the model and the experimental data is very important. We have a special situation when we use statistical methods in all experimental stages and it is called an active experiment. What involves scheduling the experiment and establishing the necessary number of experiments and the conditions for their realization;

Determining the conditions for achieving the optimal value of the process performance. prescribed by the standards, it is applied slowly and without shocks, being maintained for a duration necessary to reach the deformation. The pairs of values obtained during the test are read.

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The vibrations in the samples require 2 test frequencies, even if the breaking surface is similar, there are still changes in the initial break, in the pores and then in the metal matrix.

From the influences of the process factors and following the diagrams drawn by the STATISTICA program, it can be observed, as it also appears from the diagrams presented by the results, that the density is almost constant and we have deformations or crushing of the samples only depending on the force with which we act on the samples.

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