Pyrocermaics are brittle materials having a number of unique properties [3, 6]. When solving the problem of the use of pyroceramics in various constructions, strength is one of the decisive characteristics.

The mechanical strength of a brittle material determined experimentally depends on many factors: volume, character of the applied load, type of stress, etc. [4, 9, 10, 14, 15].

A component part of investigations of the strength of such materials should be the determination of the law governing the distribution of strength in a group of specimens from a given material [9].

Bending tests of microcrystalline glass materials (pyroceramics) have become most common owing to simplicity of manufacturing the specimens (prismatic and round) and reliability of the results obtained.

Fig. 1. Results of pure bending tests of prismatic specimens measuring 18 × 24 × 150 mm.

Fig. 2. Results of transverse bending tests of 12-mm-diam. cylindrical specimens: 1) without and 2) with consideration of place of breaking.
To investigate the strength and distribution of its values, we tested prismatic and cylindrical specimens of pyroceramic 23 under short-time static loads. The specimens were made from plates of the material with final machining of the surfaces on grinders. Prismatic specimens (geometrically identical) measuring 4.5 × 6 × 40, 9 × 12 × 80, and 18 × 24 × 150 mm were tested in pure bending. Cylindrical specimens with a diameter of 12 mm and length of 120 mm and prismatic specimens measuring 4.5 × 6 × 40 mm were tested in transverse bending.

All tests were carried out on a universal device [2] at room temperature. The loading rate in all cases was constant with an increase of stresses in the cross section of the specimen of 1 kgf/mm² sec.

The experimental strength values obtained had scattering in each group of specimens despite the rigorously controlled and identical testing conditions. It is obvious that in this case a statistical interpretation of strength acquires an essential role.

The most important advantage of the statistical theories of strength [4, 9, 14, 16] is that not only the observed scatter of the strength values in tests but also the manifestation of the effect of the scale factor are explained by means of them. However, preference can be given to some theory only when the distribution of the strength values is known.

A priori, on the basis of a theoretical analysis, it was hypothesized that the distribution of the possible strength values of pyroceramic materials is normal. The use of the normal distribution for describing the distribution of the strength indexes of the properties of pyroceramic materials is permissible, since numerous, generally independent technological factors affect the arrangement of the structural elements determining the strength of these materials.

Acceptance of the normal distribution of the local strength values

\[
P(x) = \frac{1}{\sqrt{2\pi} \sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}
\]

allows negative values, which is unacceptable in practice. However, if for the normal distribution the coefficient of variation is small (less than 1/3), the probability of obtaining negative values is so small that it can be disregarded [15]. In these cases we can use the normal distribution for describing essentially positive values, such as the strength values obtained as a result of experiment.

To describe and study the properties of the general population based on a sample from it, it is