

INVESTIGATION OF THE INFLUENCE OF TECHNOLOGICAL PARAMETERS ON THE MORPHOLOGICAL FEATURES OF CELSIAN CERAMICS

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INTRODUCTION

The creation of radiotransparent materials with a set of high performance characteristics and the development of technological parameters for the manufacture of parts of various shapes and sizes is a common need of the modern aerospace industry. Solving this problem will increase the durability and efficiency of products, improve the controllability of special equipment and reduce the cost of their maintenance.

THE AIM

Investigation of the influence of technological parameters on the morphological features of celsian ceramics, obtained by casting aqueous suspensions into gypsum molds, burnt at a temperature of 1350 °C.

TECHNOLOGY

Technical raw materials: alumina, quartz and barium carbonate.

Two-stage ceramic technology:

the first stage - the synthesis of the Celsian phase at a temperature of 1200 °C for 2 hours exposure;

the second - casting the slip into gypsum molds, drying blanks and firing products at a temperature of 1350 °C for 2, 4 and 6 hours exposure.

Preparation of the output components of the furnace feed (batch)

technical alumina	quartz sand	barium carbonate	intensifying additive
dosage	Dosage	dosage	dosage

Grinding (ball mill, until completely passed through the sieve № 0063)

Moisturizing the press powder with a solution of CCG (W=8%)

Briquetting (semi - dry pressing, 20 MPa)

Drying (drying oven, 110°C, 3 hours)

Firing (muffle furnace, 1,200°C, 2 hours)

Grinding (< 3 mm)

Grinding (planetary mill, 20 min.) (<0.1mm)

Preparation of slip (ball mill+PAR)

Casting of blanks

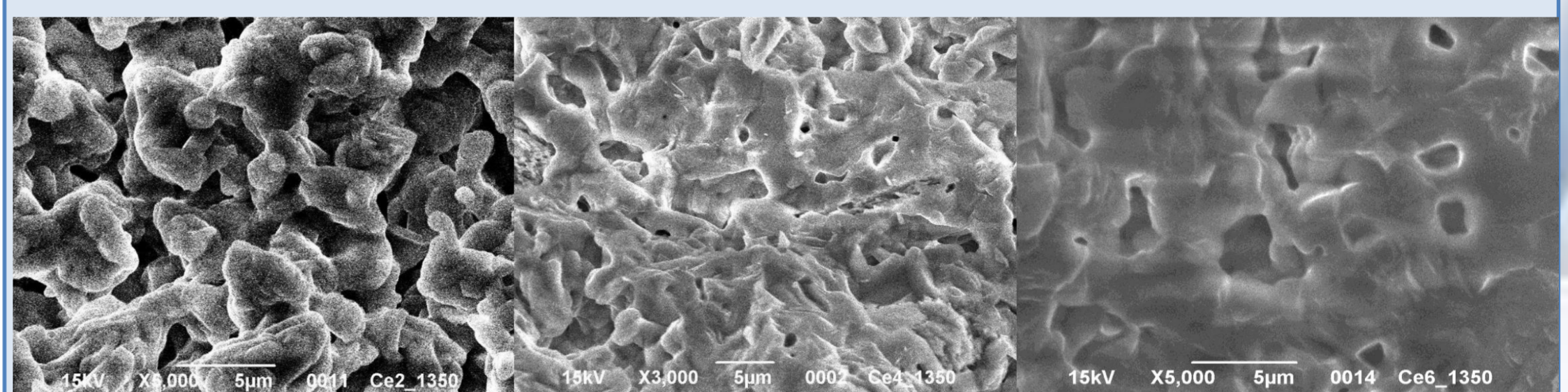
Drying (drying oven, 110°C, 3 hours)

Firing (silite furnace, 1,350°C, 2 hours)

Technological scheme of manufacturing products based on Celsian ceramics

RESULTS

For ceramic samples, the microstructure was investigated and the influence of morphological features of the structure on physical and mechanical characteristics was evaluated.



a) b) c)

Microstructure of samples of Celsian ceramics at increase of 5,000 times : a) 2 hours exposure; b) 4 hours exposure; c) 6 hours exposure

The results of the research showed high values of the flexural strength (up to 292.4 MPa) at a holding time of 4 hours at a temperature of 1350 °C. It is known that the properties of ceramics depend on the ratio of crystalline, amorphous and gas phases. The main contribution to the properties of densely sintered ceramics is made by the crystalline phase. With increasing exposure time to 6 hours, there is an increase in the percentage of glass phase in the melt of the samples due to which the yield strength decreases and the values of dielectric constant deteriorate.

CONCLUSIONS:

- ➡ The influence of the holding time at the maximum temperature on the morphological features of ceramics is established.
- ➡ The properties of the studied samples varied depending on the exposure time in the following intervals: water absorption – 4.5–6.2 %, apparent density – 2.57–2.66 g/cm³, porosity – 11.8–15.8%, flexural strength per bend – 115–292 MPa and dielectric constant – 8.7–12.2
- ➡ Further research will focus on the development of optimal technological parameters for the creation of ceramic waveguides used in the rocket industry.

