STUDY OF MORPHOLOGICAL FEATURES OF ELECTRICALLY CONDUCTIVE COMPOSITE CARBIDE-SILICON CERAMICS

Physico-Chemical nanomaterials science

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INTRODUCTION

During the martial law in the country, there is a need to develop radio-absorbing materials that would reduce the radar visibility of military equipment and weapons, protect medical equipment and buildings of critical infrastructure from the influence of side electromagnetic radiation, and also provide the ability to protect internal information.

THE AIM

The creation of composite ceramics and the study of its morphological features is an urgent task of materials science.

TECHNOLOGY

Based on the need to ensure the manufacturability of the mass, the amount of additives SiC introduced varied from 10 to 30 wt. % over 100 wt. % on dry matter.

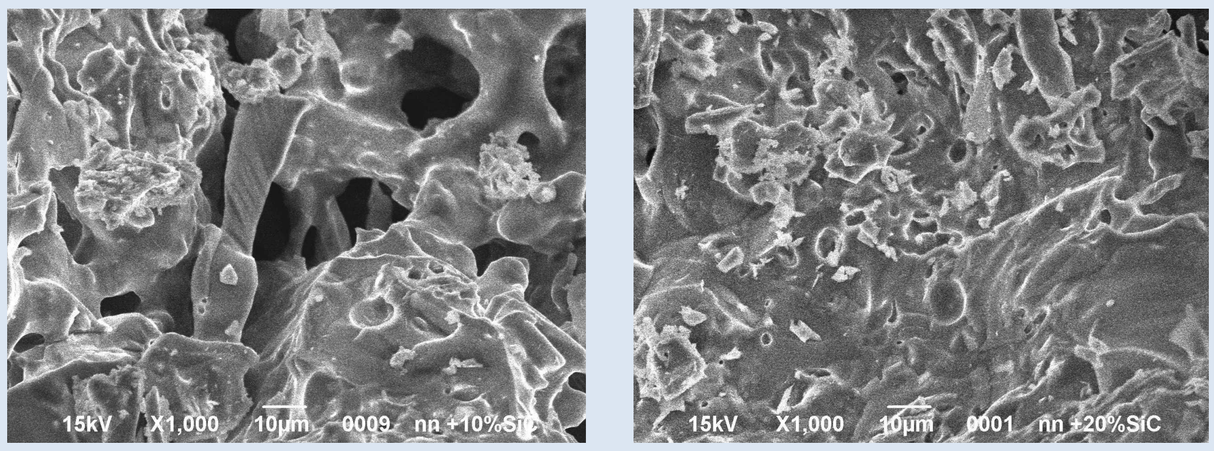
A further increase in the additive content in the ceramic tile led to the formation of defects. For the manufacture of test samples, SiC was added to the mass of the finished charge in amounts of 9.1, 16.6, and 23.1%.

Briquettes were formed by the method of semi-dry pressing with a specific pressure of 20 MPa. The resulting raw material was dried to a final moisture content of less than 1%, after which it was fired at a temperature of 1120-1140 °C with exposure for 20 minutes.

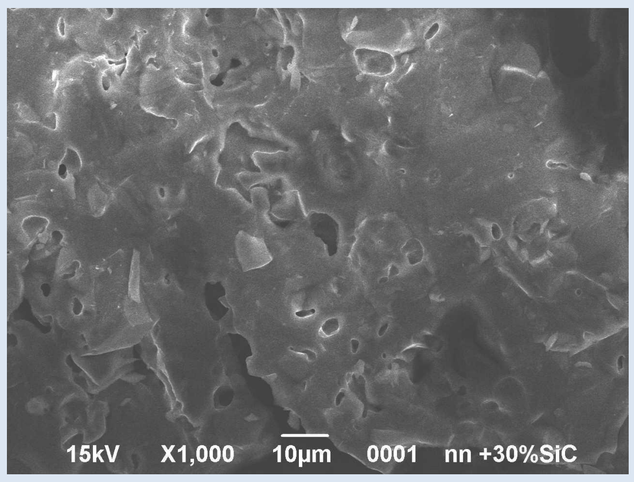
The technology of manufacturing experimental samples was close to the factory one.
The paper investigated the morphological features of the obtained samples and evaluated their influence on the physical and mechanical characteristics.

It was found that after firing ceramics with the addition of 9.1 wt.% SiC, its peaks are absent in the X-ray pattern, and when 16.6 wt.% and more are added, the peaks of primary SiC are already detected by X-ray diffraction.

RESULTS



a) b)



c)

Microstructure of samples of composite ceramics at increase of 1,000 times with : a) 10 wt.% SiC; b) 20 wt.% SiC; c) 30 wt.% SiC

In the structure, when adding up to 20 wt.% SiC, elongated pores with a size of 15-20 μm are observed, at 23.1% SiC, the pores in the structure become more rounded and decrease to 10-12 μm, which significantly improves the properties of the products.

CONCLUSIONS:

- According to the results of the research, ceramic samples with the addition of 23.1% SiC showed the best properties: water absorption – 5.7%, open porosity – 12.2 %, apparent density – 2.13 g/cm^3, resistivity – 0.4· 10^6 Om·m
- According to the obtained X-ray phase analysis data, SiC in this series was preserved in its original form, which is an important condition for effective protection against electromagnetic radiation.