

# Thematic areas of International Summer School for young scientists "Nanotechnology: from fundamental research to innovations": Nanocomposites

## Prospects for creation of ceramic radiotransparent materials

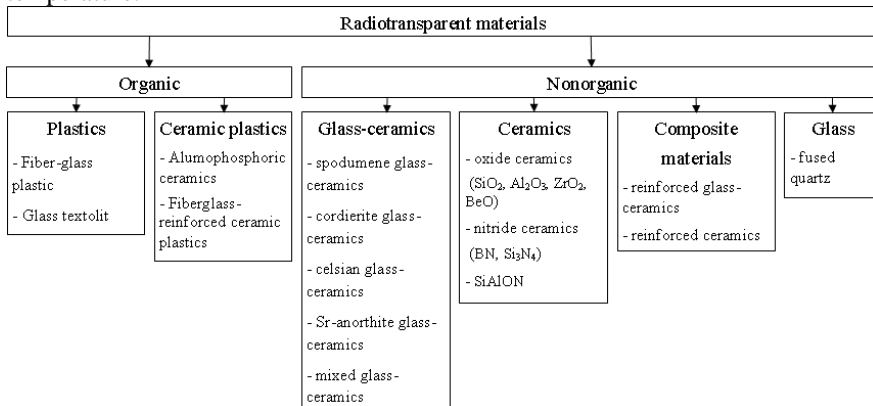
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Ceramic radiotransparent materials (CRM) are non-metallic materials, which ensure passing of the electromagnetic wave of radio frequency band. Radiopacity of ceramic materials is provided with low dielectric loss in the range of operating temperatures ( $\text{tg}\delta \cdot 10^{-2} \dots 10^{-5}$ ,  $\epsilon < 10$ ) and the low value of the coefficient of reflection of radio waves ( $P_{\text{ref}} < 1\%$ ). CRM are used to create radomes and aircrafts to ensure the transmission of electromagnetic energy, etc.

Currently a large number of materials that can be classified by origin for organic and nonorganic are being used in the world practice as radio - materials (CRM), the table below shows the currently known radiotransparent materials.

The main disadvantages of organic radiotransparent materials are the low temperature resistance (not more than 2-3 min. at a maximum temperature of 400-500 °C), as well as a significant change of dielectric properties with a rise in temperature.



The authors have found that a promising direction of CRM's creation is the use of nonorganic materials, such as technical ceramics, glass-ceramic materials and composite ceramics, which have the following advantages: high performance, mechanical-and-physical properties characteristics, durability of materials. Basic electrophysical, mechanical-and-physical properties of

radiotransparent ceramics are shown in the Table.

Indices	SiO <sub>2</sub> Corning 7941 USA	Al <sub>2</sub> O <sub>3</sub> AL-300 USA	Si <sub>3</sub> N <sub>4</sub> Ceralloy 147-01 EXP	SiAlON (AMO, USA)	Celsian glass- ceramics	Spodumene glass ceramics C-100
Density, kg /m <sup>3</sup>	1900- 2100	3800- 3960	1800-2500	2200	3000- 3100	2340
Bending strength, MPa	35-70	300- 400	50-200	532	90-110	60-80
TCLC, $\alpha \cdot 10^7, K^{-1}$	4-7	85-110	31	20	30-50	17-19
Thermal conductivity, W/m K	0,5-1,6	20-80	6	-	-	-
Dielectric permittivity, $\epsilon$	3,3-3,6	8,2-9,6	4-6	4,9	6,5-7	?
Loss-angle tangent	<0,001	<0,001	0,002-0,005	0,002	0,01	?

Based on the performed literary analysis the authors have found that the new radiotransparent materials development problem is topical not only in Ukraine, but also all over the globe.