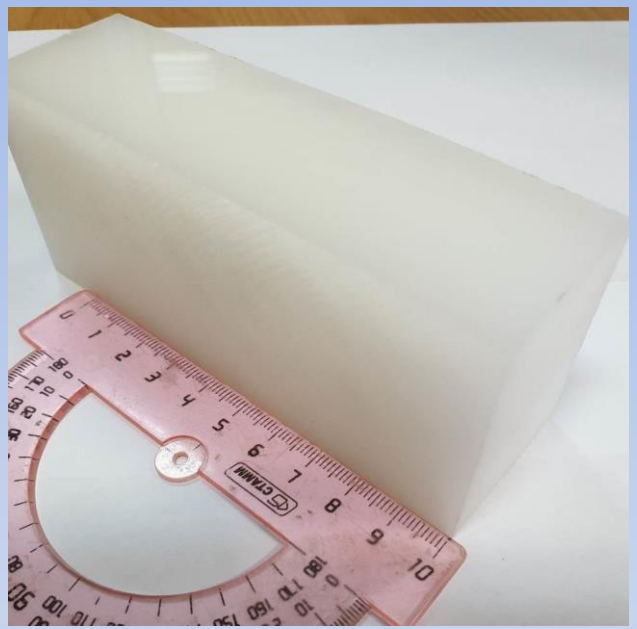
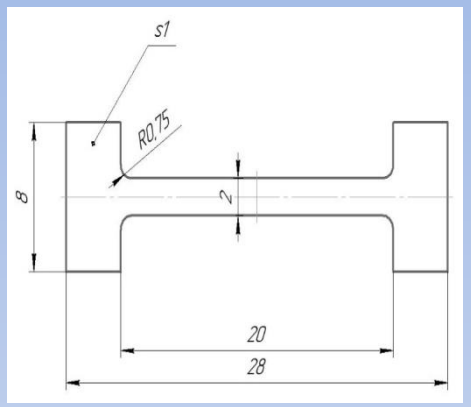
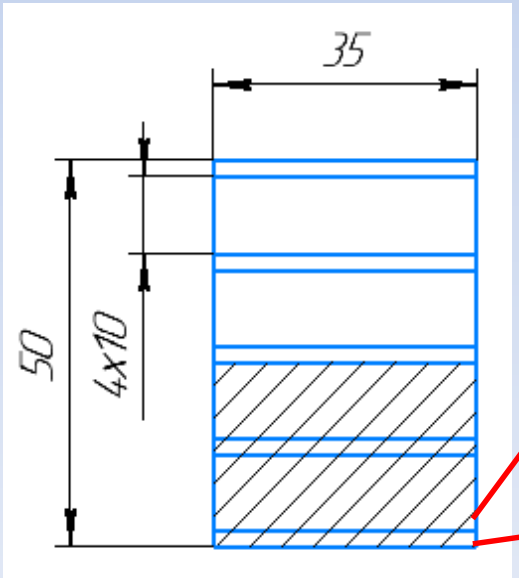
Samples preparation

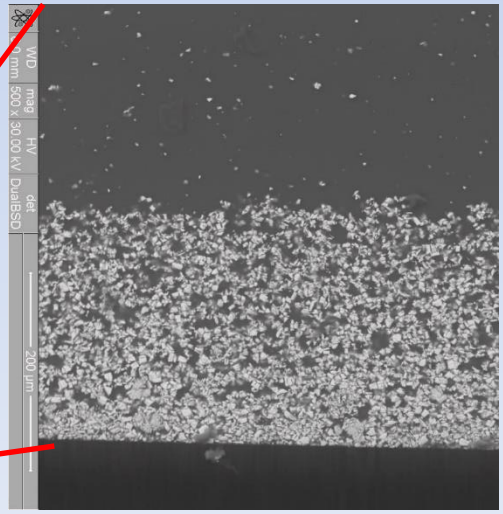


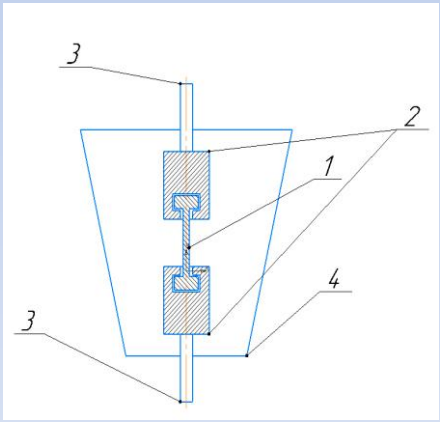


Dimensional tensile specimen



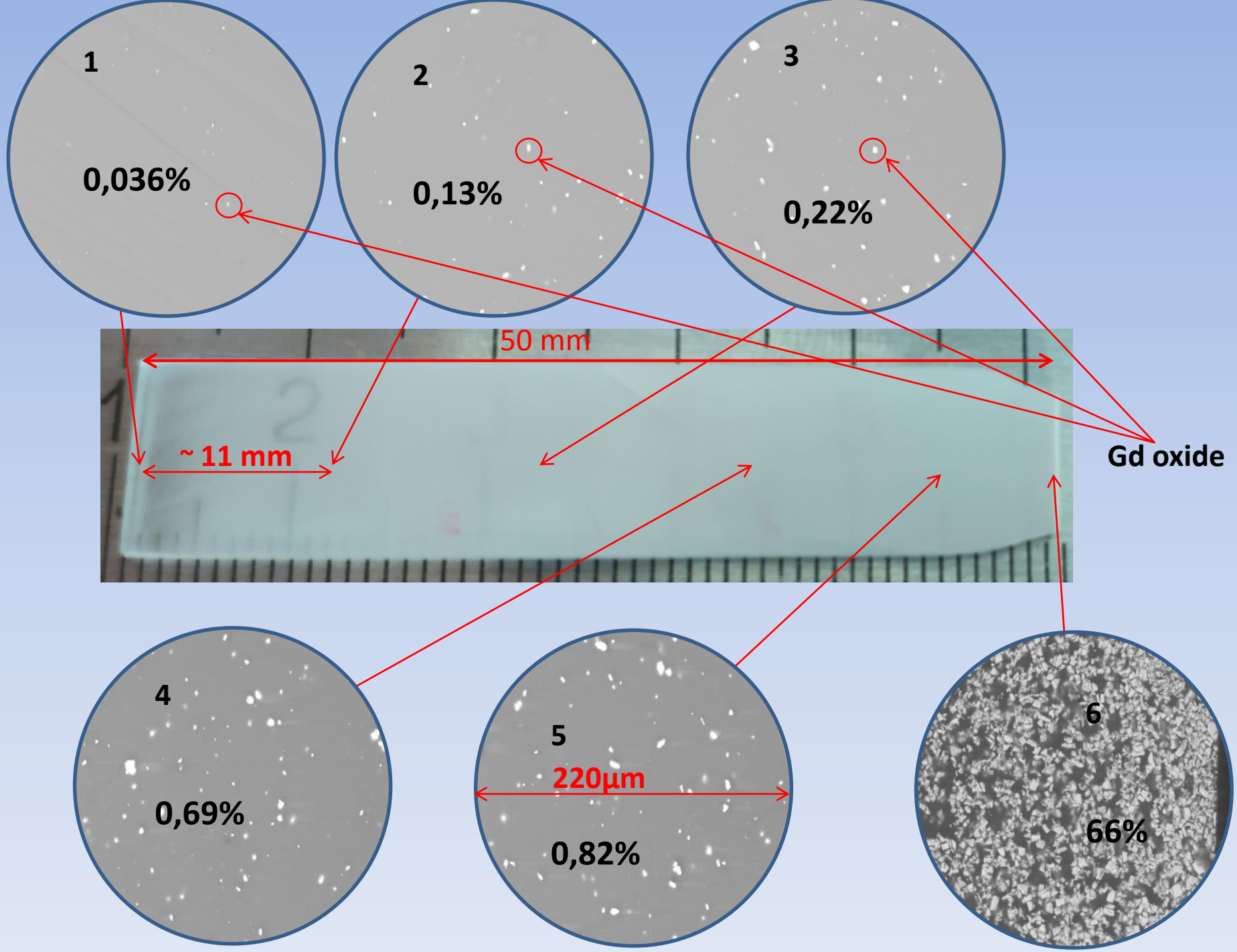
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5





Sample test scheme

1. The sample
2. Captures
3. Guides
4. Liquid nitrogen tank


1
0,036%
2
0,13%
3
0,22%
50 mm
~ 11 mm
Gd oxide
4
0,69%
5
220µm
0,82%
6
66%

Mechanical test results

	Sample	Strain, MPa	Deformation, %	Mean strain	Mean deformation
Zone 1 (-196˚C)	№1	56,6	4,69	49	4,29
	№2	41,4	3,89		
Zone 2 (-196˚C)	№1	54,8	6,81	41,2	5,81
	№2	**27,6**	4,81		
Zone 3 (-196˚C)	№1	44,1	3,98	53,5	4,08
	№2	62,8	4,17		
Zone 4 (-196˚C)	№1	56,4	5,17	59,5	5,01
	№2	62,6	4,83		
Zone 5 (-196˚C)	№1	49,8	5,14	50,2	4,46
	№2	50,6	3,78		
Zone 3 (25 ˚C)	№1	69,3	8,9	70	8,05
	№2	70,6	7,2		
PMMA (25 ˚C)	№1	69,7	4,97	70,4	6,28
	№2	71,2	7,59		
PMMA (-196 ˚C)	№1	**104**	**12,3**	104,5	12,5
	№2	**105**	**12.7**		

The mechanical properties of PMMA with gadolinium oxide are reduced due to the presence of stress concentrators in the form of large particles at cryogenic temperatures.

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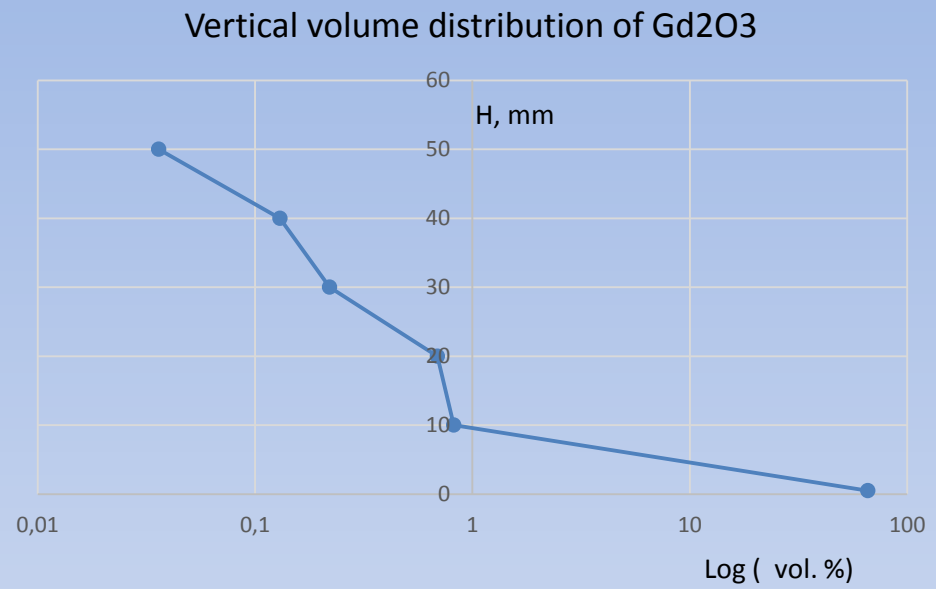
Research Findings:



1. The distribution of gadolinium oxide particles along the thickness of the sample is extremely no uniform and vary in the range of 0.036-0.82%. It means that gadolinium oxide particles concentration in the upper part of the sample is much smaller than in the lower.

2. Most of the gadolinium oxide particles are concentrated in the lower part of the sample in an area 0.22 mm thick.

3. The mechanical properties of the material at room temperature slightly differ from the properties of pure PMMA because of the low particle concentration.

4. The nucleation of cracks upon cooling occurs in the lower part of the sample where high (66%) concentration of large particles of gadolinium oxide was observed.

5. The mechanical properties of PMMA with gadolinium oxide are reduced due to the presence of stress concentrators in the form of large particles at cryogenic temperatures.