Investigation of the effect of borpolymer on the physical characteristics of ultrahigh molecular weight polyethylene

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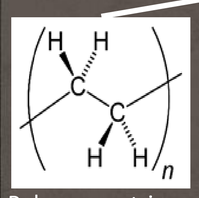
The development of raw materials in the Northern regions of our country requires the development of transport and industrial infrastructure, which requires frost- and wear-resistant materials. And the creation of new composite materials, including polymer-based (PCM), is one of the best solutions to this problem. In this work, the aim and scientific novelty is to study the effect of dissolved polymethylene–p-triphenyl ether of boric acid (borpolymer(BP)) on the physico-mechanical and tribological properties of ultrahigh molecular weight polyethylene (UHMWPE), depending on its content.

Tasks:

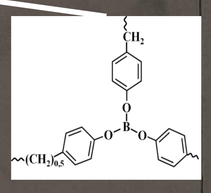
A. *Perform an analysis of the borpolymer.*
B. *To investigate the physical and mechanical properties of PCM.*
C. *To investigate the tribotechnical properties of PCM.*

Research methodology: *a set of experimental and computational methods was carried out.*

Research objects



Polymer matrix: UHMWPE GUR 4022



Filler: Borpolymer

A. Borpolymer analysis

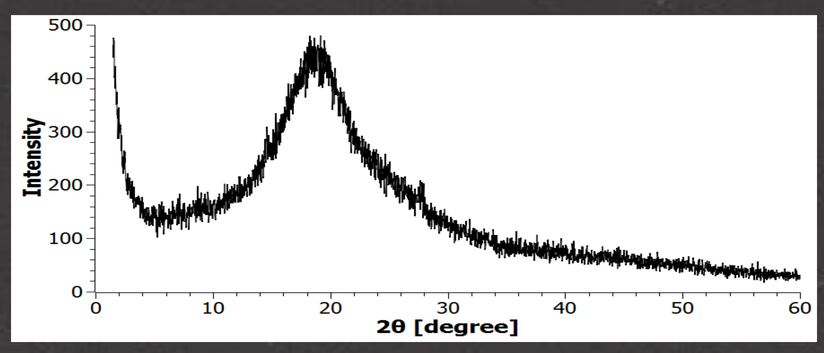


Image 1. Radiograph of borpolymer

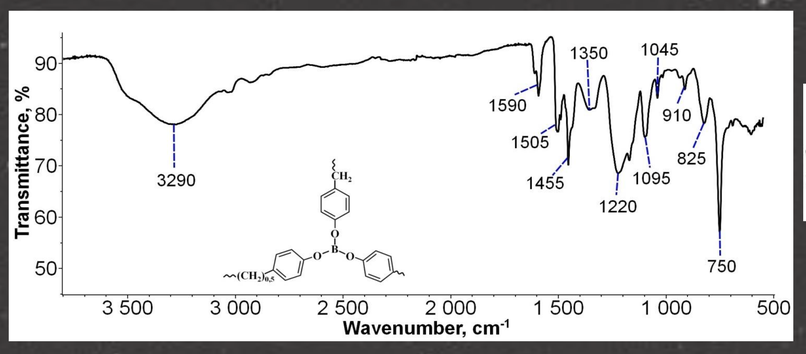


Image 2. IR spectra of borpolymer

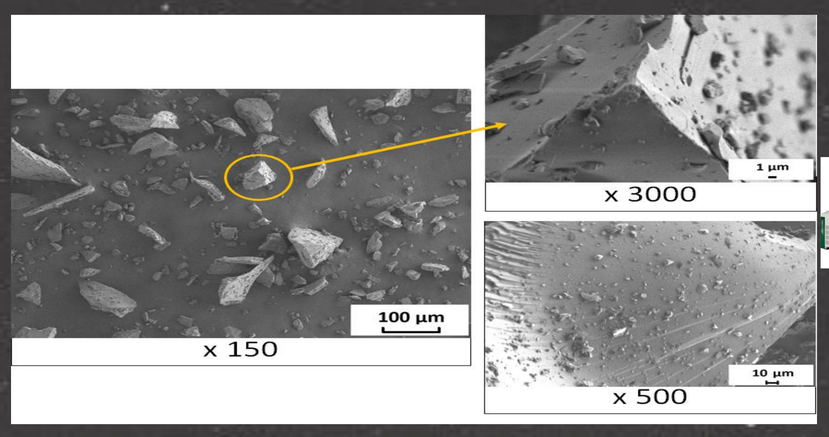


Image 3. Micrographs of borpolymer particles

B. Physical and mechanical properties of PCM under tension

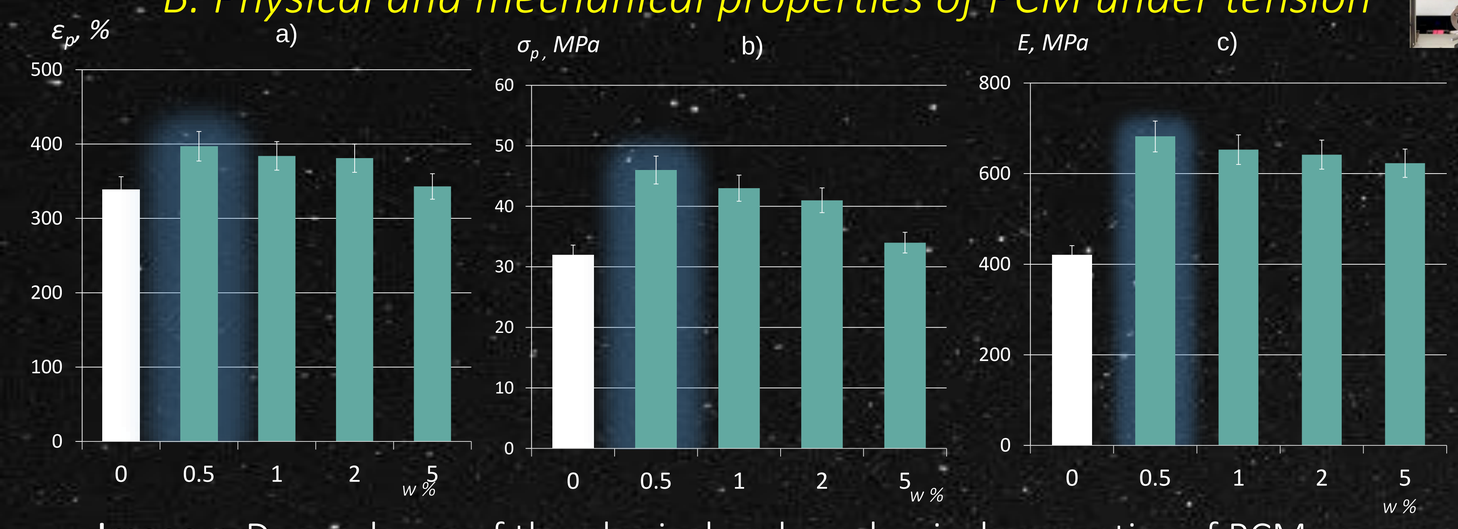


Image x. Dependence of the physical and mechanical properties of PCM on the borpolymer content:: **a)** ε_p – elongation at break, %; **b)** σ_p – tensile strength, MPa; **c)** E_p – modulus of elasticity, MPa.

Physical and mechanical properties of PCM under compression

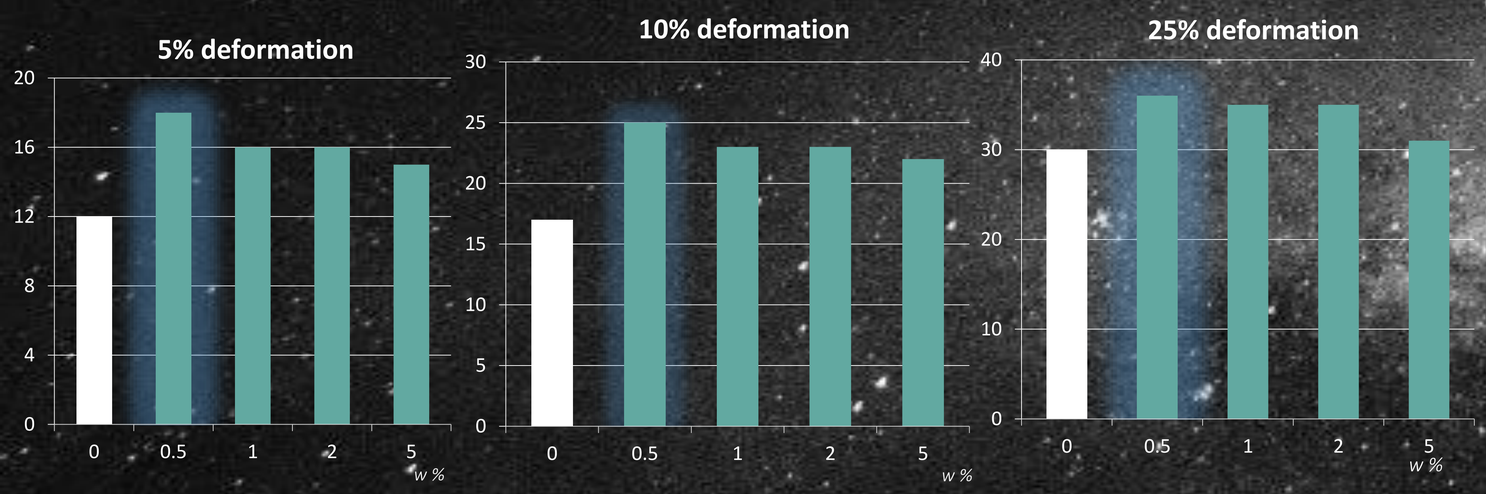


Image y. Dependence of the physical and mechanical properties of the PCM on the content of the borpolymer during compression

C. Tribotechnical properties

Sample	Coefficient of friction	Mass wear rate	Linear wear rate
initial UHMWPE	0,38	0,12	0,31
UHMWPE + 0,5%BP	0,39	0,12	0,01
UHMWPE + 1%BP	0,39	0,11	0,04
UHMWPE + 2%BP	0,39	0,25	0,02
UHMWPE + 5%BP	0,30	0,28	0,11

Technological scheme for obtaining PCM

Conclusion

It has been established that materials having borpolymer as a UHMWPE filler have increased strength and wear resistance, which determines the prospects of using the composite in machinery and vehicles operating in the Far North.

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