INVESTIGATION OF POLYIMIDE COMPOSITE RESISTANCE TO THE OXYGEN PLASMA FLOW

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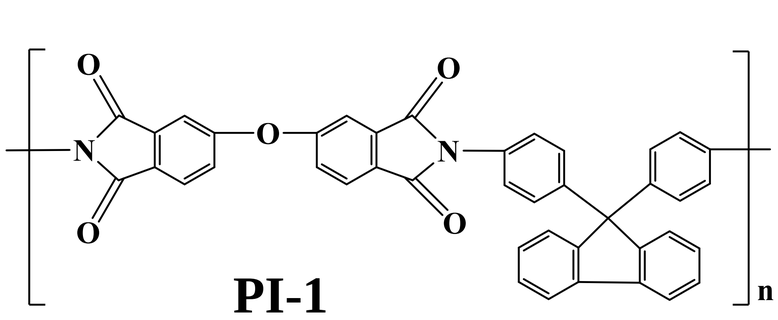
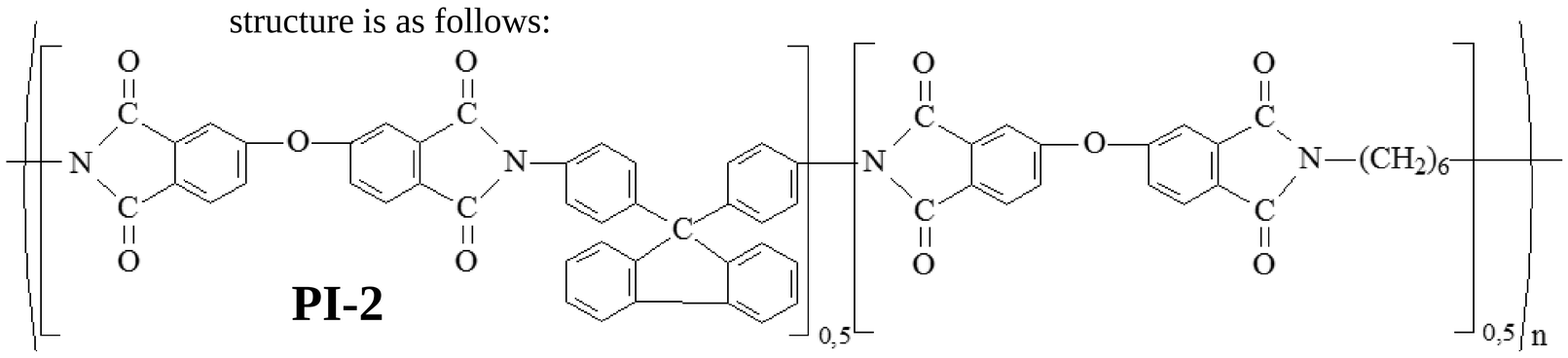
The aim of this work is to study the effect of the organic-soluble polyimide chemical structure on the morphology, properties and resistance of nanocomposites based on them to the action of atomic oxygen.

Polyimide based on 4,4'-(9-fluorenylidene)dianiline and 3,3',4,4'-diphenyloxide of tetracarboxylic acid **(hereinafter PI-1)** and a copolymer based on 4,4'-(9-fluorenylidene) dianiline, 3,3',4,4'-diphenyloxide of tetracarboxylic acid and hexamethylenediamine **(PI-2) has been used as the polymer matrix**. The molecule structure is as follows:

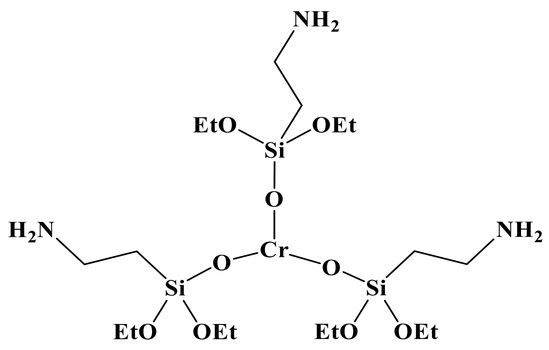


PI-1

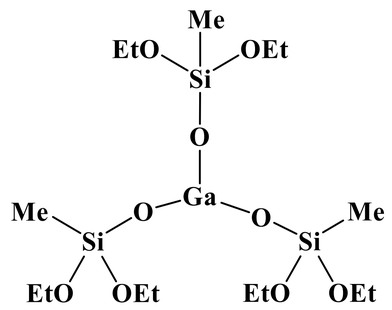


PI-2

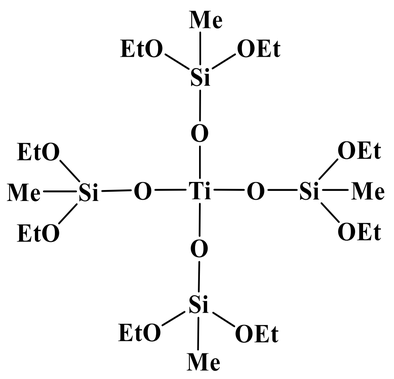
Metalloalkoxysiloxanes, differing in the nature of the central atom and the substituent at the silicon atom, namely tris-(3-aminopropyldiethoxysiloxy)chromium (Cr-siloxane), tris-(methyldiethoxysiloxy)gallium (Ga-siloxane) and terakis-(methyldiethoxysiloxy)titanium (Ti-siloxane) **has been used as** precursors of the dispersed phase of composites



Cr-siloxane

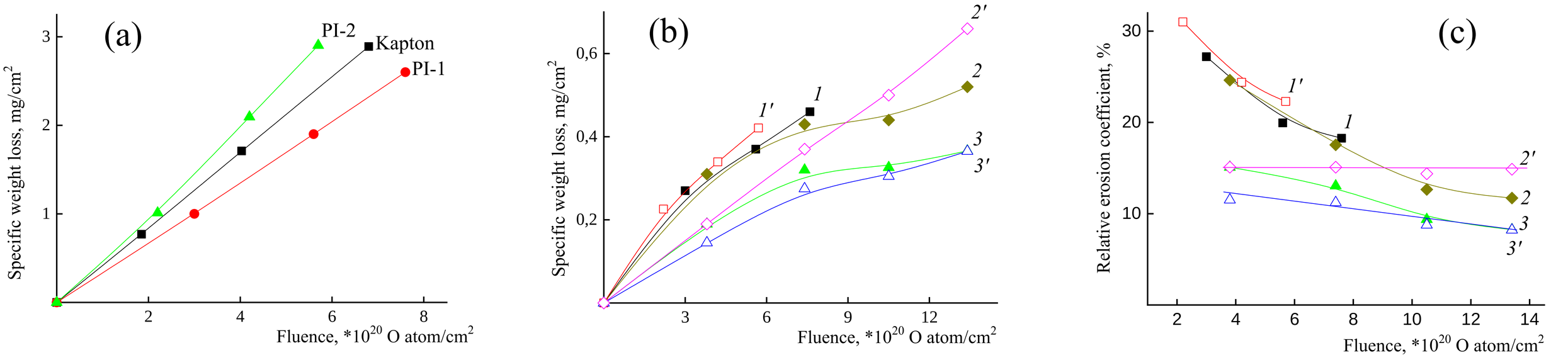


Ga-siloxane

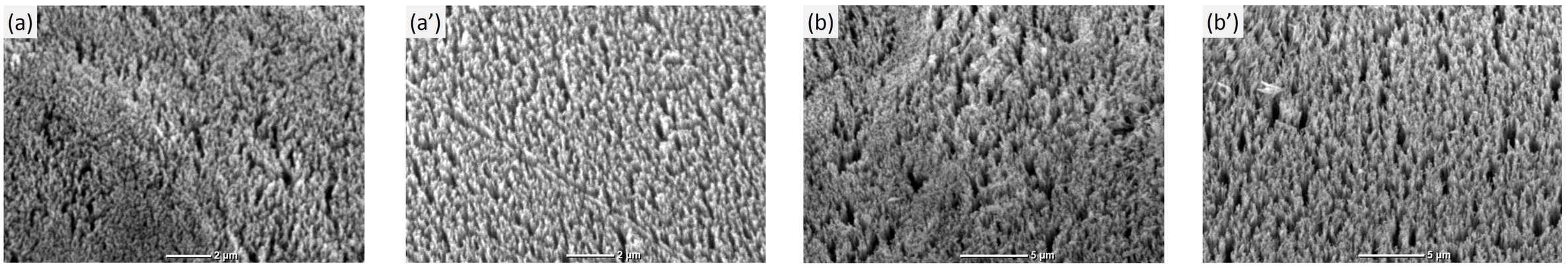


Ti-siloxane

All the samples obtained were irradiated with a stream of oxygen plasma formed in a plasma accelerator on a plasma-beam test bench of the SINP MSU simulating conditions at a low near-earth orbit



Dependence of the weight loss of samples of initial polymers (a) and nanocomposites based on them (b), and the dependence of their relative erosion coefficient (c). Composition of the compositions: PI-1-Cr-siloxane (1), PI-2-Cr-siloxane (1'), PI-1-Ga-siloxane (2), PI-2-Ga-siloxane (2'), PI -1-Ti-siloxane (3), PI-2-Ti-siloxane (3')



SEM images of the surface of irradiated AO samples of nanocomposites of composition PI-1-Ti-siloxane (a), PI-2-Ti-siloxane (a'), PI-1-Ga-siloxane (b), PI-2-Ga-siloxane (b'). The fluence is $13.4*10^{20}$ O atom / cm^2

CONCLUSIONS

- It was shown that when using the same metalloalkoxysiloxane precursor, the chemical structure of the polyimide predetermines the design and size of the nanocomposite dispersed phase.
- A higher resistance to atomic oxygen than the original polymers characterizes the filled films. Their ability to withstand the erosive effect of the incident oxygen plasma is largely due to the nanoparticles of the dispersed phase.