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THE FRICTION COEFFICIENT OF POLY(Ɛ-CAPROLACTONE) FILMS AFTER THE PLASMA TREATMENT

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Poly(ε-caprolactone) is a biocompatible and bioresorbable synthetic polymer that has been extensively studied and applied in implants for ophthalmic controlled drug delivery. Poly(caprolactone)s have found extensive use in drug delivery applications due to their attractive properties such as biocompatibility and biodegradability. Significant efforts have been made in recent years to develop stimuli-responsive systems using these polymers [1]. Through the functionalization of ε-caprolactone monomers, different stimuli-responsive properties can be instilled to the resulting polymers. Poly(caprolactone)s are usually formed through the ring-opening polymerization of ε-caprolactone monomers, which can be accomplished through different mechanisms such as anionic, cationic, or coordination-insertion [2].

The implanted poly(ε-caprolactone) material must withstand the mechanical effects of surgical instruments, and therefore it is useful to know about the tribological characteristics of the polymer implants.

The purpose of this work is to study the coefficient of friction of poly(ε-caprolactone) films after the exposure to low-temperature atmospheric plasma.

Initial film samples of poly(ε-caprolactone) were obtained from a 1% solution of poly(ε-caprolactone) with a molecular weight of Mw = 80,000 g/mol (Sigma-Aldrich, England). The each side of material was treated with low-temperature atmospheric pressure plasma (the treatment time was 30 s). Friction and wear studies were carried out using the finger-disk scheme under dry sliding friction conditions on a TRIBO technik machine (France) while varying the test duration (0,13-0,5m) and sliding speed (in the range (1.5–5) mm/s). A counterbody was a ceramic ball (diameter = 6 mm).

The range of the coefficient of friction of initial films was 0.127-0.394 (1.5 mm/s), 0.124–0.329 (3 mm/s), 0.126–0.37 (5 mm/s) (fig. 1, 2).

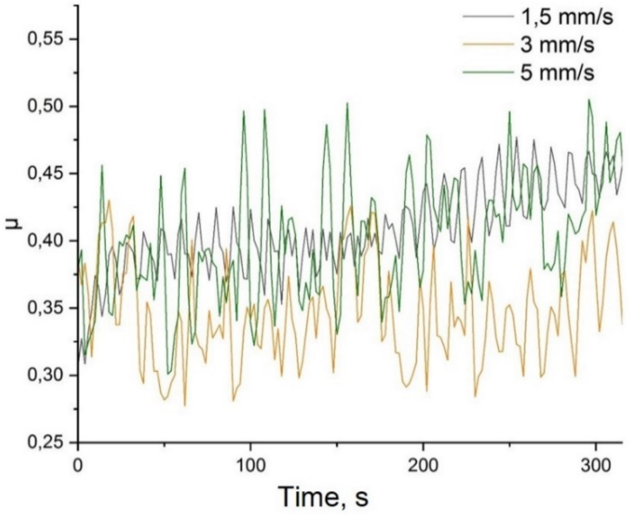

Figure 1 – The friction coefficient of initial films at sliding speed:
1 – 1.5 mm/s, 2 – 3 mm/s, 3 – 5 mm/s.

The range of the coefficient of friction of films after the plasma treatment was 0.125-0.244 (1.5 mm/s), 0.125–0.491 (3 mm/s), 0.125–0.399 (5 mm/s) (fig. 2, 3).

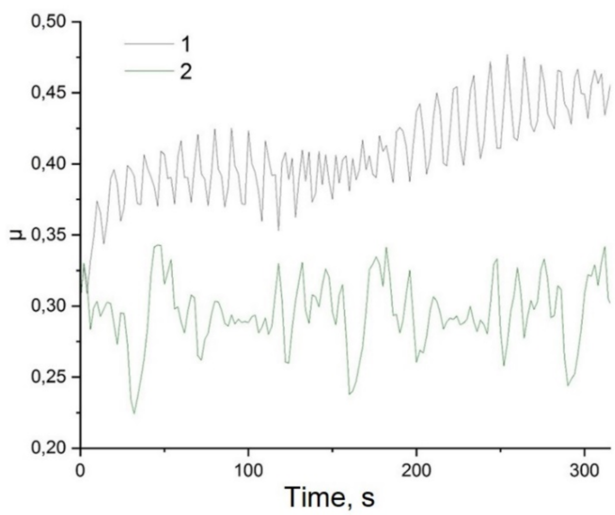

Figure 2 – The friction coefficient of the initial film (1) and the film after the plasma (2) at the sliding speed of 1.5 mm/s.

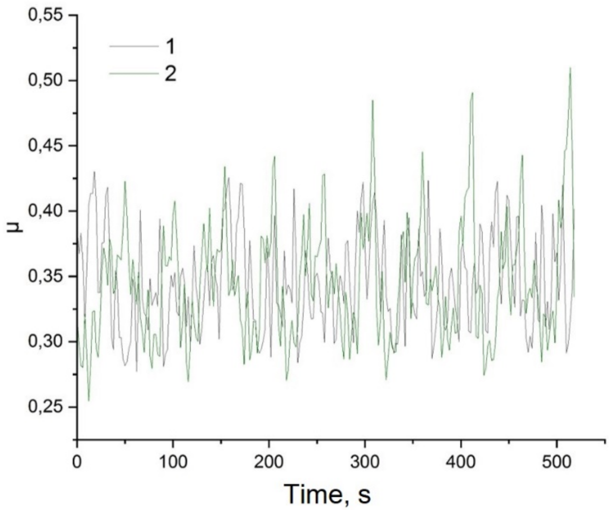

Figure 3 – The friction coefficient of the initial film (1) and the film after the plasma (2) at the sliding speed of 3 mm/s.

An increase in the speed and duration of the sliding test did not change of the friction coefficient of the initial samples and films after exposure to the plasma.

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