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ACCEPTED MANUSCRIPT

**Unusual effect evidenced at the investigations of the mechanical behavior of composite hydrogels under cyclic compression**

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#### Abstract

An unusual type of mechanical behavior was registered while studying the swollen hydrogel compositions “cellulose-polyacrylamide” in the conditions of multiple cyclic compression tests with the broad variation of the deformation speed. While increasing the deformation rate the clearly seen inversion of the positions of compression and decompression parts of the cyclic stress-strain curves was detected. While carrying out the cyclic compression tests with relatively low deformation speed (about 100-200 % of the initial sample’s height per minute) the well defined hysteresis of the stress-strain curve can be seen and in these conditions the decompression part of the curve is situated inferior the part corresponding to compression. But while increasing the speed of the deformation the tendency to the progressive approach of the compression and decompression curves to each other is clearly seen. This effect results in the full disappearance of the hysteresis at some value of the deformation speed: the decompression curve coincides with the compression curve. Along with the further increase of the deformation speed the hysteresis appears again but the curve corresponding to compression process is situated inferior the curve corresponding to decompression: the “inversion” of the hysteresis was detected. The precise character of this process depends upon the stiffness of the hydrogel under study. Up to date the convincing explanation of this effect can not be put forward. The authors can only present some hypotheses to explain this phenomenon.

**Keywords:** Hydrogels, Artificial cartilage, Mechanical properties, Cyclic compression behavior

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