PHYSICO-CHEMISTRY OF FRICTION INTERACTION OF SYNTHETIC AND
NATURAL POLYMER MATERIALS

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One of the most effective and complex solution for the problem of preserving natural properties of raw
woven, particularly of cotton fiber – the most valuable textile raw material – is applying anti-friction
polymers and composite materials and coatings of them to contacting surfaces of cotton processing
machines’ components. This approach allows reducing mechanical damage of cotton and significantly
decreases expenses for energy and metal consumption by extending useful life of working parts of
machines due to protecting them from wear and corrosion. However, friction coefficient (or force) –
which is widely used for calculations in machines and mechanisms design, – is static parameter and
insufficiently describes the friction interaction physico-chemical processes, that causes thermo-
oxidizing and other mechano-chemical processes.

Observing the processes of friction interaction of bodies from position of energy self-organizing
allows evaluating the changes of materials structure and surface properties more precisely.

Our investigations show that from position of thermodynamics of irreversible processes tribo-system
polymer-cotton is open unbalanced thermodynamic system. Continuous unbalanced processes of
thermal conduction and diffusion appear during such friction interaction. This caused by differences of
values of thermodynamic parameters such as tribo-electric charge density, temperature and its uneven
concentration on factual contact area under influence of energetic factor pv – pressure by speed of
sliding. These parameters of friction interaction are gradient values which characterize the tribo-
system’s thermodynamic misbalance. Therefore, comprehensive physically justified generalization
and developed on its basis models and methods of evaluating must be based on fundamental laws of
thermodynamics.

In summary, we can conclude that significant difference of thermodynamic and tribologic parameters
on friction interaction depends on kind and properties of coating material and there is a relation
between them: the more values of thermodynamic parameters of friction interaction, the more friction
force and, therefore, the more intensity of coatings wear and mechanical damage of cotton.