4th International Symposium on
Energy Challenges & Mechanics
- working on small scales

11-13 August 2015
Aberdeen, Scotland, UK

The Mechanochemical Component of Friction Force at Interfaces

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Accepted for publication on 8th June 2015

Friction and triboelectrification of materials show a strong correlation during sliding contacts. Experiments to determine friction coefficients on tribocharged dielectric surfaces are highly affect by electrostatic charges. As a result, friction coefficients at the macro- and nanoscales increase many-fold when surfaces are tribocharged. Adhesion maps and force-distance curves recorded on dielectric surfaces exposed to friction show that the region of contact increases the pull-off force from 10 to 150 nN, reflecting on a resilient electrostatic adhesion at the interfaces. Also, stick-slip phenomena (friction force fluctuations) are always accompanied by two tribocharging events at metal-insulator [e.g., polytetrafluoroethylene (PTFE)] interfaces: injection of charged species from the metal into PTFE and charge transfering from the insulator to the metal surface. In conclusion, tribocharging may supersede all other contributions to macro- and nanoscale friction coefficients (including van der Waals forces and gravity) in dielectrics and other materials.

Keywords: mechanochemistry; friction force; electrostatic charges; stick-slip.