On the understanding of the SuperLubricity Phenomena in Ceramic contacts

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Ever since superlubricity was first observed during water lubricated sliding tests of ceramics, there has been an increasing interest in their tribological behavior due to the remarkable scientific, technological and environmental importance of this finding.

Recently, the authors observed that at the DLVO zone (4<pH<10), where there is electrostatic repulsion, the superlubricity phenomena takes place and the wear is very low when the electrostatic repulsive pressure overcomes the applied pressure (Prep < Papp). This occurs when a specific combination of a large contact area (r), low composite roughness (Sq < 0.7 µm), small film thickness (h ≈ 5nm) and final pH values within the DLVO zone come about. If these conditions are not satisfied the superlubricity phenomena will not occur.

The aforementioned findings were obtained during a series of lubricated sliding tests using a ball-on-disc setup in a Plint Micro Controled TE67 machine. The ball was made of Si_3N_4 and the disc of Al_2O_3. Several operating conditions (load, speed and temperature) and lubricants (waters with different pHs, oils and ethanol) were used.

These tests also provided enough knowledge to optimize the running-in period, the wear-volume and the friction force by playing with the electrostatic repulsive pressure of the tribosystem.

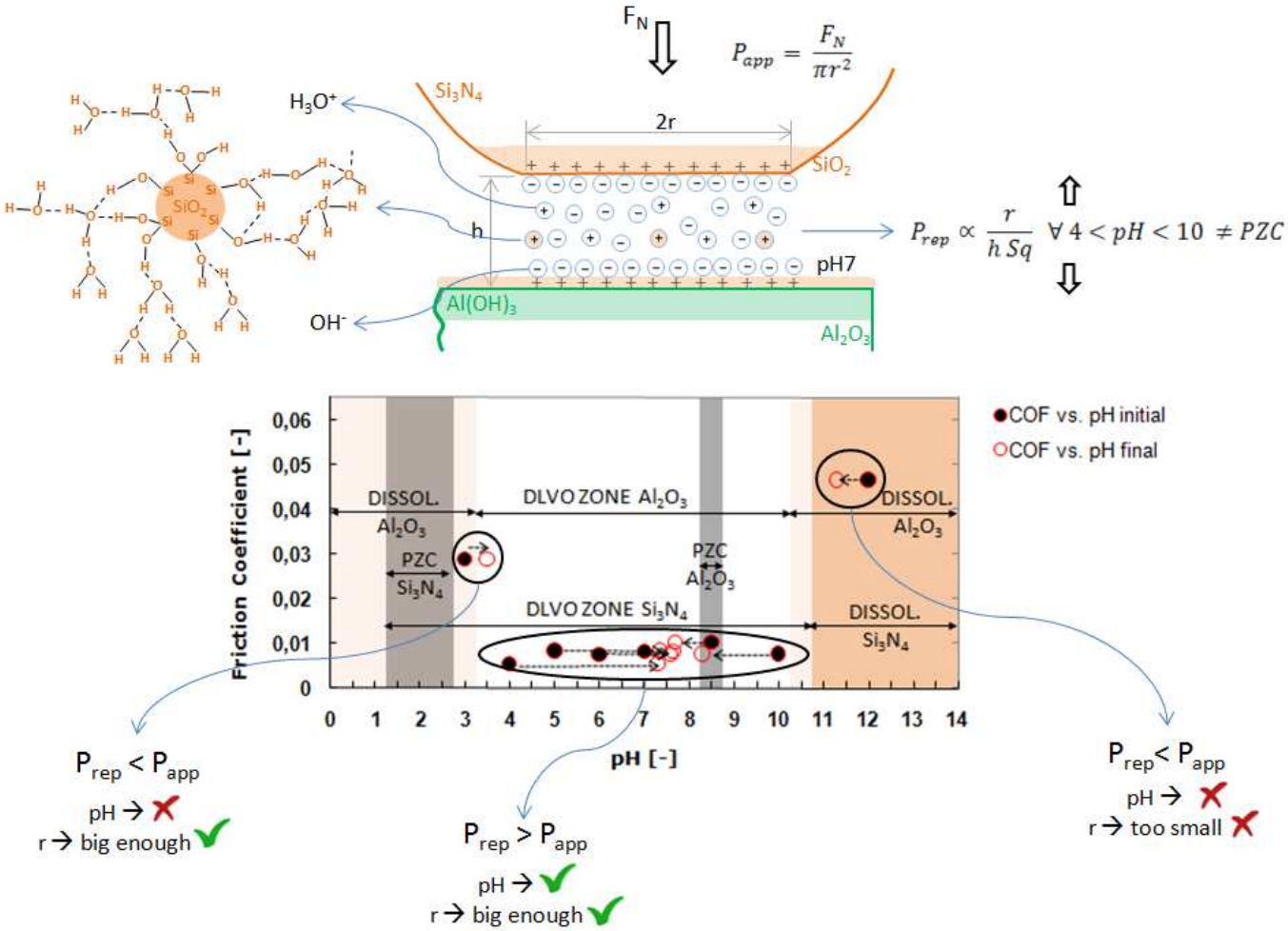

Figure 1. Schematic representation of the tribosystem of the dissimilar pair Si_3N_4–Al_2O_3 under pure sliding condition and pH7 water lubrication.

To the interested reader see http://www.sciencedirect.com/science/article/pii/S0301679X15001449