Gerd Kaupp, Int J Mater Sci Res. 2018
http://dx.doi.org/10.18689/2638-1559.a2.001

madridge CONFERENCES

2nd International Conference on
Materials Science and Research
September 26-27, 2018 Frankfurt, Germany

On the Way to Physically Correct Indentation Analyses

Gerd Kaupp
Department of Chemistry, University of Oldenburg, Germany

Common indentation analyses suffer from iterations, polynomials, and approximations, in order to get along with an incorrect description of the force-depth curve. There is not the "quadratic relation", also assumed in FE-simulations, but a simple undeniable one-page physical deduction proves the empirically found $F_N = k\ h^{3/2}$-relation. It opposes counter-physical ISO 14577 that violates the first energy law with faulty hardness and elastic modulus (values and dimension, also falsely claiming Young's modulus!) and cannot detect phase transition under load. All types of materials should now be characterized with H_{phys} (0.8 k : penetration resistance from >3 or >4 nines regression correlation) with the correct dimension (it is the first physically defined hardness ever) and with the not iterated indentation modulus $E_{r\text{-}phys}$. The correct mathematically clear physics offers unexpected applications of nano- and macro-indentation data. Some of these are detection of surface effects and phase changes under load, including their transformation energy and activation energy, all with simple algebra. It includes the determination of correct adsorption energies and should correct all mechanical properties that are still derived from the faulty "H_{ISO}" and "E_{ISO}" suppositions. This adds increased precision. Clearly, daily life is still at risk as long as counter-physical ISO Standards are not changed: When suppressing basic physical laws, materials fail despite security by not properly fitting together, or because industrial indentations do not exclude multiple phase-transitions, creating interfaces as nucleation sites for cracks that might end catastrophically. The correct physics is of course promising. It requires acknowledgement and further development.

Biography:

Dr. Gerd Kaupp studied chemistry at the University of Würzburg, Germany and was postdoc at Ames, Iowa, Lausanne, and Freiburg i. Br, from where he became associate professor and since 1982 full professor at the University of Oldenburg. He served as guest professor and is now retired and consulting. His expertise is in chemical kinetics, laser photochemistry, waste-free productions, solid-state chemistry, mechanochemistry, atomic force microscopy AFM, scanning near-field optical microscopy SNOM, indentation, standardization in nano-mechanics. He has been keynote speaker in these fields, published numerous scientific papers and books and is inventor of patents in solid-state and environmental chemistry.