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Consequences of the physical foundation of the exponent 3/2 in pyramidal/conical (nano) indentations for the mechanical parameters and for daily life

The recently published physical foundation of the experimental exponent 3/2 for pyramidal indentations (validated since 2003 by the author, while ISO still dictates exponent 2 from textbooks and work of half a century) on the depth *h* in relation to normal force F_N creates dilemma for industry and security agencies. They have to obey ISO standards with legal character, even though physics tells differently. Even NIST (US member of ISO) published 6 new mechanical parameters in a tutorial that continues distributing "false physics" using exponent 2. We must thus urgently try to change that situation, because falsely calculated mechanical properties severely harm all public in daily life, in medicine (implants with bone cements), and techniques. Material's compatibilities (including solders) and mechanical stress are ubiquitous, to name a few. Material's failures have been claimed as fatigue of materials, rather than calculations against physics. Errors are with finite element simulations always resulting with exponent 2, unnoticed phase transitions with their onset and energies, or surface effects. These are only recognized when applying exponent 3/2, but not by polynomial curve fittings, or "best exponent iterations". Almost all mechanical parameters require re-deduction on the basis of the correct exponent. ISO-hardness *H* and ISO-modulus E_r are doubly flawed: they rely on the false exponent against physics and they often unconsciously characterize after phase transitions. All materials require genuine physical characterization! Thus, physical *H*, E_r and other parameters (adhesion energy, etc.) have to be deduced. This will be addressed upon, and we will find unexpected applications.

Biography

Gerd Kaupp has completed his PhD from Würzburg University and Post-doctoral studies from Iowa State, Lausanne, and Freiburg University. He held a full-Professorship till 2005 in Oldenburg, Germany, and he privately continues his research on AFM on rough surfaces (since 1988), the as yet better resolving sub-diffraction limit microscopy also for non-fluorescing materials, even rough ones, of all types (resolution <10 nm, since 1995), and nano-indentations (since 2000). He has published more than 300 papers in renowned journals and has been serving as an Editorial Board Member of several scientific journals.

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