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The physical foundation of the exponent 3/2 on the depth h instead of Sneddon's 2 for conical or pyramidal indentations

Unfortunately, most Berkovich indentation loading curves are still claimed to follow the Sneddon exponent of 2 on h and most finite element simulations try to support it, even though the experimental exponent 3/2 on h has been hundred folds secured with linear correlation coefficients $r > 0.999$ or often > 0.9999 of published loading curves dealing with all kinds of indentation techniques, materials and response mechanisms, since 2000. Authors continued believed in 2 and avoiding their exponent check. Even worse, nano and micro-mechanical parameters continued to be deduced based on the unsupported exponent 2 in a tutorial from NIS for biophysicists, leading to incorrect material properties. Conversely, applications of the correct loading exponent are highly versatile, much more reliable and precise than hardness and modulus. Penetration-resistance provides finer details, which are particularly important for biological/medicinal analysis and mappings of alloys and composites. Importantly, penetration resistance, indentation energy, phase transitions with their transition energy, activation energy and adhesion energy are accessible without iterations. The exponent 3/2 allocates 80% of the applied indentation work for the penetration and 20% for all additional processes. The appreciation of this wealth of unexpected applications presumably requires the physical reason for the new exponent which was still lacking. Fortunately, the deduction of the exponent 3/2 for conical and pyramidal indentations (against textbook claims) can now be given on an elementary basis. The elementary mathematical formalism will be presented. This is new physics that can no longer be denied. It helps avoiding dangerous failures in medicine and technique.

Biography

Gerd Kaupp has completed his PhD from Wurzburg University and Post-doctoral studies from Iowa State, Lausanne and Freiburg University. He held a full-Professorship till 2005 in Oldenburg, Germany. 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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