Conventional Meyer hardness as a superior measure for plasticity of solids

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Recent advances in depth-sensing indentation tests of solids have revealed a quadratic relation between applied load and displacement (penetration depth) of the pyramidal and conical indenter. Using this relation, an extremely simple equation is satisfied:

where is the energy consumed in creating an indentation impression, is the volume of the residual indentation impression, and is the conventional Meyer hardness defined by the ratio of applied maximum load to the projected area of the indentation impression after complete unloading. This equation demonstrates that the conventional Meyer hardness is a plausible modulus for plasticity of solids and is equivalent to the energy for creating a unit volume of residual indentation impression. The conventional Meyer hardness can be measured using both the recently developed depth-sensing indentation testers and conventional dead-weight indentation testers. The vast data accumulated using conventional testers over almost 100 years can thus be re-evaluated in terms of the consumed energy and the volume of the impression.