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| Sommario/riassunto | The present collection of articles focuses on the mechanical strength properties at micro- and nanoscale dimensions of body-centered cubic, face-centered cubic and hexagonal close-packed crystal structures. The advent of micro-pillar test specimens is shown to provide a new dimensional scale for the investigation of crystal deformation properties. The ultra-small dimensional scale at which these properties are measured is shown to approach the atomic-scale level at which model dislocation mechanics descriptions of crystal slip and deformation twinning behaviors are proposed to be operative, including the achievement of atomic force microscopic measurements of dislocation pile-up interactions with crystal grain boundaries or with hard surface coatings. A special advantage of engineering designs made at such small crystal and polycrystalline dimensions is the achievement of an approximate order-of-magnitude increase in mechanical strength levels. Reasonable extrapolation of macro-scale continuum mechanics descriptions of crystal strength properties at micro- to nano-indentation hardness measurements are demonstrated, in addition to reports on persistent slip band observations and fatigue cracking behaviors. High-entropy alloy, superalloy and energetic crystal properties are reported along with descriptions of deformation rate sensitivities, grain boundary structures, nano-cutting, void nucleation/growth micromechanics and micro-composite electrical properties. |