Quest for room temperature ductility in ceramics

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Ceramics, including inorganic glass materials, are an integral part of the modern world, but their usefulness in engineering is limited due to their characteristic elastic brittle fracture at room temperature. As an exception to the rule, recent discovery shows that amorphous aluminum oxide (a-Al_2O_3) is a rare diatomic glassy material exhibiting significant nanoscale plasticity at room temperature (Frankberg et al. Science ***2019***, 366, 864). Later, the discovery was expanded to show that room temperature plasticity of a-Al_2O_3 extends to the microscale and high strain rates associated with impact-type loading, such as hammer forging (Frankberg et al. Adv. Mater. **2023**, 2303142). Large-scale molecular dynamics simulations and finite element simulations align with the main experimental observations and unravel the plasticity mechanisms at the atomic scale (Zhang et al. Acta Mater. **2023**, 259, 119223). The results are consistent with the theoretical prediction that low-temperature plasticity observed in a-Al_2O_3 can extend to macroscopic bulk scale if the material is free of processing flaws. Such material has significant potential to be used as light, high-strength, and damage-tolerant engineering material, for example to induce a leap in the damage-tolerance of smart devices and foldable touch screens. Results also indicate that it is feasible to experimentally produce such flaw free samples at a bulkier scale.