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On the use of machine learning to investigate the fracture toughness of ceramic nanocomposites

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Stronger and tougher materials are highly needed to meet the challenges and growing needs of diverse strategic fields from energy storage to transportation to advanced manufacturing. Ceramic nanocomposites are suitable candidates due to their unique mechanical and chemical properties, since they combine the traditional ceramic material characteristics with exotic nanomaterial features. Empirical solutions and finite element simulations are usually employed to investigate the mechanical properties of these materials. However, these approaches often exhibit various limitations, e.g., significant deviations of material properties provided by different experimental methods, labor-intensive/time consuming computations. These challenges are addressed by machine learning that leads to major improvements in terms of both reliable functionality and rapid deployment. Machine learning opens up a new way of investigating properties and standardizing novel testing methods of complex materials.