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Comparison of zirconia toughened alumina fracture toughness obtained from Vickers indentation by applying various equations
(Conference Paper)

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Abstract

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Alumina ceramics (Al_2O_3) displays excellent mechanical properties highly demanded in various fields of application. However, low fracture toughness (K_{IC}) property of the alumina ceramics limits their functionality such as heavy-duty forming tools and refractories. Adding a second composition, yttria stabilized zirconia was aimed to improve the K_{IC} property of alumina ceramics, producing a zirconia toughened alumina (ZTA) ceramics composite. Vickers indentation technique was employed in this work to determine the hardness and K_{IC} of ZTA ceramics as it requires only a small area of samples surface to be tested and is cost effective. ZTA ceramic composite was indented with 1 kgf load, three indentations each. The average hardness from the Vickers hardness testing of ZTA was recorded and the crack length was measured using scanning electron microscope (SEM). There is a wide variety of empirical equations available to determine the K_{IC} for Vickers hardness test, however most of the equations are said not to be in a good agreement with the K_{IC} value obtained from three point bending test. Thus, hardness and crack length parameters were incorporated in the various empirical equations available to measure the fracture toughness value. It was shown that the crack propagation follows Palmqvist model, and Eq. 4 ($K_{IC}=0.0134(E/H_v)^{1/2}(P/c^{3/2})$) is the most suitable in determining the K_{IC} of ZTA. © 2019 Author(s).

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