

Propagation of Indentation Cracks in Alumina Induced by Thermal Shock Experiment

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In general it is not trivial to determine the mechanical properties of ceramic components, which are too small to machine specimens for conventional test setups. In addition, it may be of interest to test a surface in the as-fired or production surface finish. Machining of specimen to a specific norm results in an “artificial” surface, which is not representative of the actual component. Small bars made from 92% liquid phase sintered alumina with two as-fired and two machined sides were indented with a Vickers diamond at different loads and subsequently thermal shocked from temperatures between 200 and 500°C in room temperature water. Crack propagation was measured employing the vicinal light method. Utilizing linear-elastic fracture mechanics and the indentation crack length measurements as a function of known applied load, the stress necessary to grow the crack was calculated. From these results, the local temperature gradient was estimated for various immersion conditions. The experimentally obtained stress values from the thermal shock will be compared to finite element simulations. The results obtained are being used to develop design and product acceptance guidelines.

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