HIGH FREQUENCY ACOUSTIC EMISSION MONITORING IN NANO-IMPACT OF BULK CERAMICS

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Acoustic Emission (AE) monitoring is proving a powerful technique in improving our understanding of deformation processes occurring at the nano- and micro-scale [1-3]. The recent development of advanced high frequency AE sensor systems and their integration to commercial nanomechanical test instrumentation has been a catalyst for research into damage processes in scratching thin films [2,3]. In recent studies AE detection revealed the onset of cracking otherwise undetectable but subsequently confirmed by FIB sectioning.

In this current study the high frequency AE technique has been used to investigate the cracking behavior of bulk technical ceramics (MgO-partially stabilized zirconia (PSZ) and zirconia-toughened alumina (ZTA)) at low strain rate in nanoindentation and at higher strain rate in the nano-impact test. Although both ceramics were susceptible to indentation or impact-induced cracking it was more prevalent on PSZ.

The influence of accelerating force and probe geometry were explored in the higher strain rate tests with cube-corner and 5 mm radius spherical diamond indenters. Large bursts of AE were observed at the abrupt displacement step in repetitive impact with a cube corner but were generally much smaller/absent during other impact events. The AE response with the 5 mm radius probe was quite different with smaller displacement events and AE bursts on most impacts at higher load.

References

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