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COHESIVE AND ADHESIVE FRACTURE UNDER NANOSCALE CONTACTS: ENVIRONMENTAL AND MICROSTRUCTURAL EFFECTS

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Present study evaluates fracture in ultra-small volumes utilizing nanoindentation combined with the nanoscale in-situ imaging and Acoustic Emission (AE) monitoring. Recently developed AE sensor integrated into an indenter tip provided a greatly increased sensitivity to contact loading induced transient processes. This enabled detection of AE events for the ultra-light contacts below 1 mN and assured an adequate basis for the AE signal analysis. Evaluated phenomena included fracture initiation in bulk materials, thin film cracking and film/substrate delamination. Indentation curves and in-situ images of the indented areas were correlated with the AE waveforms. Advanced procedures of AE signal decomposition provided additional information on separation of plasticity and fracture induced contributions of AE signals.