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Dynamic fracture toughness of TAC/CNTS/SIC CMCS prepared by spark plasma sintering

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This study focuses on the dynamic fracture toughness of TaC and carbon nanotubes (CNTs) reinforced SiC ceramic matrix composites (CMCs), that prepared by a two-stage spark plasma sintering (SPS) technique. A high densification of 98.4% was achieved under the sintering parameter of 133°C/min, 1800°C and 90 MPa pressure. Vickers indentation was employed to measure the static fracture toughness on the polished surface of ceramic samples; SEM was applied to directly observe the crack propagation after indentation; and split Hopkinson pressure bar (SHPB) was developed to determine the dynamic fracture toughness within the ceramic samples subjected to an impact in a three-point bending configuration. The result indicated that,the dynamic fracture toughness for SiC ceramics was 4.71-8.36 MPa·$m^{1/2}$, which was higher that the quasi-static toughness of 3.88 MPa·$m^{1/2}$. It was found that SiC ceramics exhibited a more strain rate dependent property for higher strain rate.Fracture toughening mechanisms of CNTs deflection and CNTs bridging were directly observed by SEM.

Biography

Qiaoyun Xie, PhD, is the graduate researcher in the department of Mechanical Engineering & Materials Science at University of Pittsburgh. Her R&D areas focus on the micro and thermo-mechanical property degradation of nano particle/fiber reinforced composites at high strain rate dynamic loading conditions, and material model development to characterize the dynamic profile of energy absorption, damage initiation and propagation. Her recent work involved in the design, manufacturing and characterization of a new hybrid system of carbon nanotubes (CNTs) and TaC reinforced SiC ceramic composites to resist oxidation, dynamic impact and fracture damage, that for the application in aerospace turbine engines and space vehicles.

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