

FRAGMENTATION, SLIDING, AND INTERFACE DEGRADATION IN SiC/SiC COMPOSITES

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BN fiber coatings in SiC/SiC composites are vulnerable to oxidation and volatilization at elevated temperature in the presence of water vapor (Fig. 1). These processes lead to coating recession in the composite interior with recession fronts starting from matrix cracks and proceeding axially along the fibers. In some operational domains, the main effect of recession is to de-couple the fibers from the matrix, precluding load transfer that would otherwise occur through frictional sliding. Here we present a mechanics framework to address effects of coating recession on composite strength. The framework is built upon the characteristic strengths and transfer lengths that govern fiber and matrix fragmentation. It leads to identification of several behavioral domains, shifts in domain boundaries due to recession, and the characteristic stresses and time scales associated with strength reduction (Fig. 2).

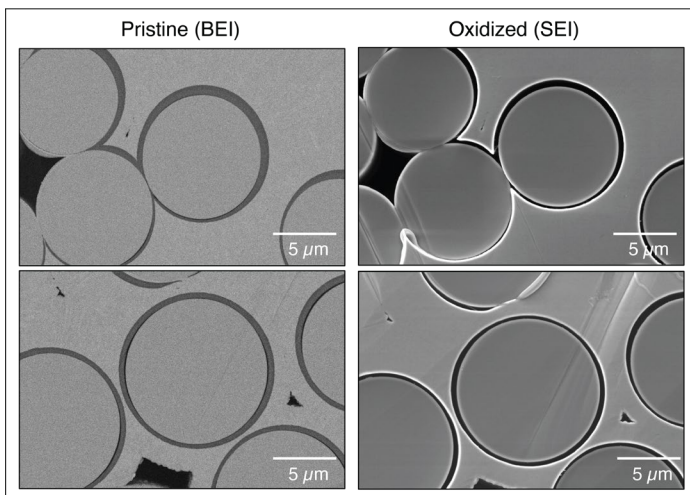


Fig.1 Examples of coating volatilization during oxidation at 1000°C. [V.L. Christensen, F.W. Zok, unpublished]

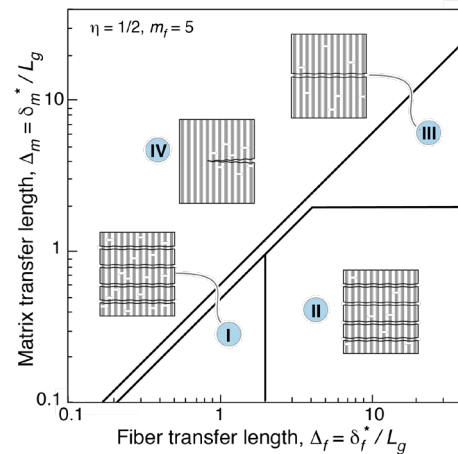


Fig. 2 Boundaries between behavioral domains in pristine composites. [F.W. Zok, V. Collier, M.R. Begley, J. Mech. Phys. Solids, 2021]