Fiber properties govern critical mechanical properties of ceramic matrix composites (CMCs). Oxidation impacts SiC fiber strength and therefore SiC-SiC CMC performance. More rapid and less costly CMC development and transition requires less reliance on empirical methods to quantify environmental effects like oxidation, and more reliance on physics-based mechanisms and models. This is particularly true for multi-year effects that cannot be easily characterized by experiment. Modeling of CMC properties requires accurate identification and modeling of oxidation mechanisms that affect CMC constituents, particularly fibers. Lack of basic data and mechanistic models for environmental effects on fiber properties inhibits understanding critical to advancement of CMC design and life management.

The oxidation kinetics, scale crystallization kinetics, and strength after oxidation of SiC fibers in air, steam and low pO\textsubscript{2} is reviewed. Data for steam oxidation between 500 and 1600°C is presented, including some results that suggest changes in oxidation mechanism above 1500°C in steam. Mechanisms that degrade strength after oxidation are identified. Strengths of SiC fibers can be predicted from the effect of SiO\textsubscript{2} scale residual stress on SiC surface flaws after oxidation in dry air. Tensile thermal stress in crystalline scales degrades strength, while compressive thermal and growth stress in glass scales increases strength. However, in wet air and steam, other mechanisms also contribute to strength degradation, and residual stress by itself is insufficient to predict oxidized fiber strength in many cases. Between 700 and 900°C glass SiO\textsubscript{2} scales dewet SiC fibers during steam oxidation. Dewetted scales then crystallize, and active oxidation of dewetted areas is inferred to occur by transport of Si(OH)\textsubscript{4} from bare fiber to spheroidized cristobalite. Possible effects on oxidized SiC fiber strength are discussed.