Supporting Information

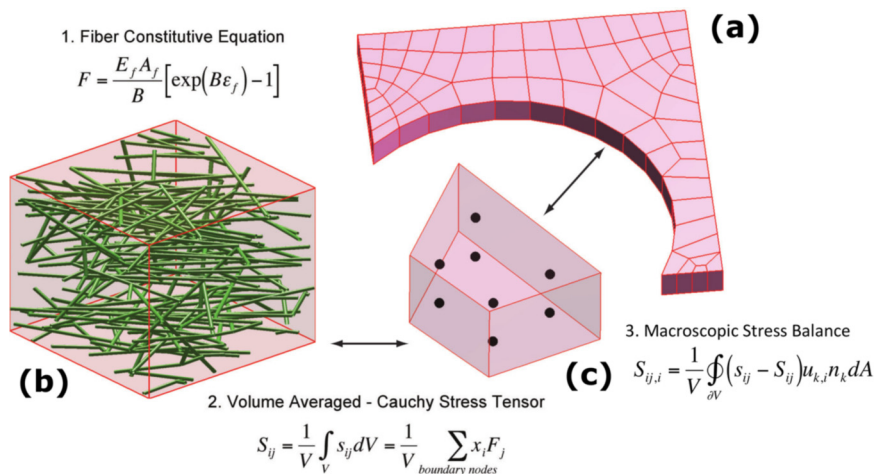## Sander et al.   10.1073/pnas.0903716106

Fig. S1. Schematic depicting the volume averaging scheme used for the multiscale simulations. (*a*) The macroscopic domain of one quadrant of the cruciform is modeled with Galerkin finite elements. (*b*) RVEs, which represent the microscopic domain, are centered at each of eight integration points (black dots) within an element. (*c*) Each RVE contains a network of cross-linked fibers. The fibers develop forces (1) when the RVE boundaries deform in accord with the macroscopic displacement field and rearrange to satisfy the force balance over the RVE. The microscopic and macroscopic domains are connected at each integration point through volume averaging (2). The volume-averaged stresses at the integration points are used in the macroscopic stress balance (3) to determine the element nodal displacements. The RVE boundary displacements are adjusted accordingly, and the whole process iterates until convergence is achieved.

Other Supporting Information Files

[SI Appendix (PDF)](#)