Silk: Materials, Processes, and Applications
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This work introduces silk fibers at a level appropriate for graduate students unfamiliar with the topic and primarily focuses on applications in textiles and medicine. Chapter 1 describes the types of natural silks from different organisms, focusing on worms and spiders, with phylogenic references. Chapter 2 gives a basic overview of the protein structures, crystallinity, and wetting behavior of worm and spider silks, the two most utilized silk forms. In future work, it would be useful to describe the unique process of natural silk protein folding during fiber-spinning and the changes that occur in the structure and properties when exposed to water. Chapter 3 discuss silk processing, beginning with treatment techniques used to degum worm silk, a process which isolates silk fibers from cocoons. These techniques include treatment with detergents, ionic liquids, enzymes, and caustic chemicals. Chapter 4 introduces regenerated silk fibers, which are silks dissolved in solvents such as hexafluoroisopropanol or concentrated lithium bromide, and then respun into fibers. Chapter 5 covers electrospinning as a fiber-spinning process and the effects of silk type, solvent system, and additives such as carbon nanotubes on fiber morphologies and properties. The processes of degumming, solubilizing, and spinning regenerated silk fibers could be relevant to separating and spinning fibers from other protein-based materials. Chapter 6 covers silk fiber applications, focusing on medical applications where silk-based products have had the most success outside the textile industry. Chapters 7-8 look forward, discussing new work in 3D printing of silks, primarily for use as scaffolds, and future applications including sensing, energy, and electronics.

The overview of silks and their structures is a broad, clear description for any reader and the book's references up-to-date. Several chapters provide useful descriptions of silk processing and applications, which would be particularly useful for researchers already familiar with the silk literature. While the level is not appropriate for a textbook, the book will be helpful to readers looking to use silk processing techniques and materials or perform similar experiments to those it describes, as it contains many tables describing the properties of silk materials from the articles it reviews. It also has an abundance of figures that aid in organizing concepts and complementing the results reviewed in the text. Synthetic silk proteins and fibers are briefly discussed in Chapters 5, 6, and 8; a more thorough discussion on how they are synthesized, processed into fibers or films, and their material properties would be beneficial in future work as significant developments enabling large-scale manufacturing of silk-based devices emerge.

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