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Structures, Mechanical Properties and Applications of Silk Fibroin Materials

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Abstract

For centuries, *Bombyx mori* silkworm silk fibroin has been used as a high-end textile fiber. Beyond textiles, silk fibroin has also been used as a surgical suture material for decades, and is being further developed for various emerging biomedical applications. The facile and versatile processability of silk fibroin in native and regenerated forms makes it appealing in a range of applications that require a mechanically superior, biocompatible, biodegradable, and functionalizable material. In this review, we describe the current understandings of the constituents, structures, and mechanical properties of silk fibroin. Following that, we summarize the strategies to bring its mechanical performance closer to that of spider dragline silk. Next, we discuss how functionalization endows silk fibroin with desired functionalities and also the effects of functionalization on its mechanical properties. Finally, from the mechanical point of view, we discuss various matrices/morphologies of silk fibroin, and their respective applications in term of functionalities, mechanical properties and performance.

Keywords

Silk fibroin, in vivo processing, β -sheet crystallites, mechanical enhancement, functionalization, bioapplications

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