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Analysis of protein secondary structure in silkworm and spider silk fibroins using Raman spectroscopy — •Emilia Pozarowska[1], Tomasz Runka[2], and Jan Ingo Flege[1] — [1]BTU Cottbus - Senftenberg, Germany — [2]Poznan University of Technology, Poland

Spider silks carry outstanding mechanical properties, such as the combination of high strength and large extensibility. The aim of this work is to investigate the protein secondary structure, in particular β - sheets, occurring in silkworm and spider silk fibers from different species, by Raman spectroscopy. The analysis of the Raman spectra provides information about characteristic conformations, such as amide I, III and protein secondary structure. A Steatoda grossa spider silk was compared with a silk of the Bombyx mori silkworm. The former shows smaller amount of β - sheets and more random coil and/or α - helix, suggesting better elastic properties. Furthermore, the analysis of dragline silks of 16 different spider species was performed resulting in specific Raman fingerprints corresponding to the silk structure and the sequence of amino acids within. Dragline silks of P. alticeps and S. grossa exhibit a larger contribution of proline and carbonyl (C=O) groups compared to other species. Data of polarized Raman spectroscopy confirmed the parallel alignment of the molecular chains to the fiber axis for all spider silks. Stress-strain curve measurements of one selected spider silk, tubiliform silk of S. grossa, revealed very good mechanical properties, i.e. a maximal strain of approximately 12.2% and final tensile stress at break of 1575 MPa.

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