

AMSilk®-Coatings – general description

AMSilk's **Spidersilk** is a material perfectly suited to coat most synthetic or natural materials. Due to the nature of **Spidersilk** almost any surface can be efficiently coated to modify surface properties. **Spidersilk®Shield** changes the surface charge, enables further functionalization through chemical coupling to the Shield before or after coating, provides a barrier and is biocompatible.

Background

Spidersilk consists of proteins produced by AMSilk. These proteins are inspired by natural spiders silk, a unique high performance protein designed by nature over millions of years.

Proteins generally consist of chains of amino acids with each having different physicochemical properties. The amino acids carry different charges and are hydrophilic or hydrophobic. The resulting protein molecules differ greatly depending on the underlying amino acid sequence. Most proteins thus are comprised of hydrophilic and hydrophobic amino acids – making them more or less amphiphilic.

AMSilk's **Spidersilk** is composed of alternating and evenly spaced hydrophobic and hydrophilic modules, making them amphiphilic



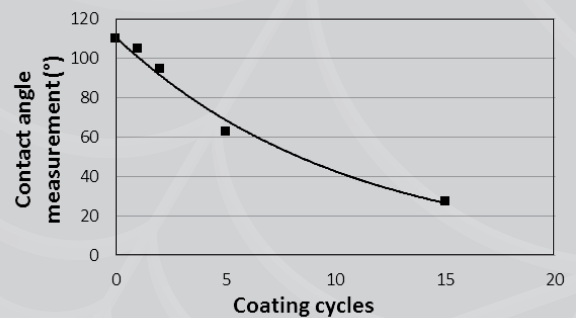
and thus allowing them to adhere to nearly any surface. Depending on the property of the substrate to be coated (hydrophilic or hydrophobic), the spider silk proteins interact differently with the surface, altering the surface properties. (Protein-Based Materials; McGrath and Kaplan; Birkhäuser 1996).

Spidersilk uses these properties and combines them with biocompatibility and a barrier function resulting in a unique coating, **Spidersilk**

Shield. AMSilk has available a set of **Spidersilk** proteins offering a range of adjustable properties (hydrophobicity / hydrophilicity, charge) that can be adjusted.



Hydrophobic to hydrophilic



Coating Technology

Different types of coating methods can be used to apply a **Spidersilk Shield**: spin-coating, spray-drying, drop-casting and dip-coating. The method is chosen and adjusted based on the surface to be coated and the final properties desired. **Spidersilk Shield** can be applied using various environmentally friendly aqueous solutions, yet the resulting coating is not water soluble and highly resistant to pH, temperature and solvents.

From Technical to Medical Coatings: A Wide Range of Possible Applications

Spidersilk Shield coatings can be applied to many different surfaces including metal, polymer, ceramic, glass, textile, natural fibers, and stiff or elastic materials. Depending on the desired properties, the coating thickness can be adjusted from a few nanometers to micrometers.

Spidersilk Shield

Silk coatings are transparent in the visible range and show a high brilliance. Even dull surfaces can become shiny and smooth after

Spidersilk treatment. The thin and homogeneous silk coating can additionally smooth out a rough surface.

Surface Modification – Wettability

The **Spidersilk** coating drastically changes the surface properties of the substrate. The arrangement of protein molecules onto a hydrophobic substrate results in a more hydrophobic surface and vice versa.

Chemically Modified Silk Surfaces

Spidersilk consists of well-defined monodisperse molecules, which can be chemically modified or functionalized before or after coating. The possibilities of such modifications (bio-conjugation) include dyes, small molecule pharmaceuticals or bioactive agents, polymer chains, peptides, and inorganic nanoparticles.

Biocompatible Coating

The **Spidersilk** material has been shown to be safe and biocompatible. As a result it can be applied to develop coatings for implants or other medical devices. In a first immunogenicity study in the mouse, no immune response was observed to two **Spidersilk** materials. **Spidersilk Shield** consists of proteins that consist entirely of naturally occurring amino acids. Most types of implant materials (e.g. silicone, polyurethane or polytetrafluoroethylene) such as used in reconstructive implants, catheters and stents can be efficiently coated with **Spidersilk**.

Barrier Function

Spidersilk Shield provides a completely biocompatible barrier. In medical applications, a temporary barrier can be built, providing protection in a critical or acute phase of the product life cycle, after which it will be desorbed. Breakdown products are non-toxic, natural amino acids.

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