Innovative Surface Treatments for Textile Performance Improvement

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Importance of surface properties

Generally, textile products are characterized by a high surface area

Textile surface properties play a fundamental role in the overall textile performance (interaction between textile and environment/body)
Modification of surface properties lead to new material features and new end-uses

Modification of basic properties
- Roughness
- Softness
- Surface tension

Introduction of new functionality
- Flame retardancy
- Repellency (water, oil, stain)
- Anti-bacterial
- Anti-odour
- Mechanical and chemical resistance
New textile functionality through surface modification

Modification of surface macro- and micro-structure

Increase of contact surface
- wettability
- dyeability

Decrease of contact surface
- repellency
New textile functionality through surface modification

Surface chemical modification

Flame retardancy
- Halogenated compounds
- Metal oxides
- Intumescent compounds
- DNA !!!

Water-Oil-Stain repellency
- Paraffins
- Silicones
- Fluorinated compounds
- Dendrimers
- Ormocers (organic modified ceramics)
New textile functionality through surface modification

Surface chemical modification

Anti-bacterial / Anti-odour
- Silver
- Enzymes

Shielding effects (heat, EMR)
- Metals (-oxides)
- (nano)-Ceramics

Body heat regulation
- PCMs (µ-encapsulated)
- Volatile compounds (µ-encapsulated)

Active/passive release
- Drugs (µ-encapsulated)
- Fragrances (µ-encapsulated)
- Insect repellents (µ-encapsulated)
Different methods for surface modification

Coating

Spray Deposition
Different methods for surface modification

Plasma Treatment

High energy ionized gas

Interaction with the textile surface

Centrocot Atmospheric Plasma Machine
Different methods for surface modification

Plasma Treatment

Vacuum
- Batch process
- High energy consumption
- High costs
- Cleaning and maintenance to avoid cross-contamination
- Use of high reactive or toxic species
- Lab-scale / Prototype-scale

Atmospheric
- Continuous process (in-line)
- Low energy consumption
- Low cost
- Easy-to-Use
- Lab-scale / Prototype-scale / Industrial scale
Different methods for surface modification

**Plasma Treatment**

**Etching**
- Erosion of textile surface
- Increase of surface roughness
- Increase of the surface area

**Grafting**
- Surface functionalization with chemical groups formed in plasma phase
- New surface properties of the textile, due to the grafting of chemical groups
Different methods for surface modification

Plasma Treatment

**Innovative process**
- Low energy consumption
- Water-free
- Low chemical consumption
- Low waste production
- Green Chemistry-oriented

**Textile applications**
- Hydrophilicity
- Water-Oil-Stain repellency
- Dyeability
- Wettability
- Printability
- Adhesion
- Color fastness
- Anti-felting
- Dimensional stability
Different methods for surface modification

Chemical Vapor Deposition

Gas phase synthesis and deposition of compounds on textile surface

Chemical modification of textile surface and introduction of new properties/functionalties
Different methods for surface modification

UV-Curing

- Polymerization by UV irradiation
- UV bulb lamps or UV LED lamps
- Different UV-curable formulation
  - Water based
  - Solvent-free
- High process speed
- No or low textile heating
- Energy saving
- In-line with conventional treatment (coating, impregnation)
Evaluation of Textile Surface Properties at Centrocot

Water-Oil-Stain repellency

Contact angle

Spray Test

Oil repellency Test

Stain repellency
Evaluation of Textile Surface Properties at Centrocot

Roughness/Friction

Mechanical resistance

Friction test

Martindale abrasion test
Evaluation of Textile Surface Properties at Centrocot

Flame retardancy

Body heat regulation

Fire test

Comfort test
Evaluation of Textile Surface Properties at Centrocot

Anti-bacterial

Microbiological test

Release of substances

Emission test
Thank you for your attention

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