Surface treatments for Sefar's woven fabrics

Introduction

Surface quality of a woven fabric has become an increasingly important factor which influences the property of the filter in many different ways. Surface treatments modify the functionality of the woven fabric according to the different requirements and thereby significantly increase the effectiveness of the resulting filter in a specific environment.

Sefar has a long experience not only in manufacturing precision woven fabrics but also in modifying fabric surfaces. Sefar offers the following surface treatment technologies:

- wet chemical surface modification (mainly hydrophilic and hydrophobic)
- low temperature plasma treatment (mainly activation, functionalisation and plasma polymer deposition)
- metal coating (aluminum, copper and nickel coating)

Depending on the application for the Sefar product, the suitable surface treatment is applied to the woven fabric. Almost any kind of Sefar product can be treated with these technologies. Further information on surface treatments can be found under: www.sefar.com/Filtration/Fabrics & Media.

Excellent spreading and wicking behavior

Sefar fabrics increase the speed and accuracy of diagnostic test strips
Sefar's high precision woven fabrics represent an important component of diagnostic test strips. They increase the speed and reliability of the test strips, which are used to monitor a persons state of health.

Due to their homogeneous woven structure and hydrophilic surface properties, Sefar fabrics guarantee excellent spreading and wicking performance, for even the smallest sample volumes. While the high wicking rates are due to the specific weave constructions, the high wettability is achieved by hydrophilic surface coatings.

Suitable surface coatings are either wet chemical surfactants or hydrophilic plasma treatments.

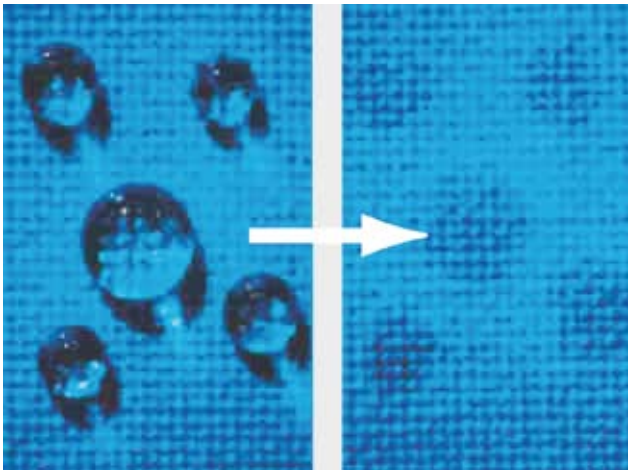


Fig. Comparison of untreated fabric and hydrophilic treated fabric

The selection of the appropriate fabric type and coating depends on the functionality needed for the test.

The phenomenon of wetting or non-wetting of a solid by a liquid is better understood by studying what is known as contact angle of a liquid drop on a condensed surface. The lower the contact angle between liquid drop and fabric surface, the better the hydrophilic action of the fabric.

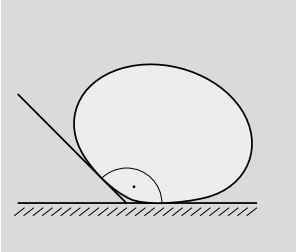


Fig. High contact angle = hydrophobic fabric

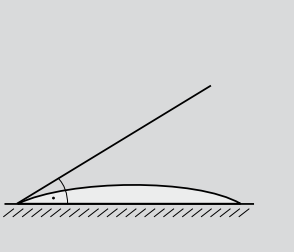


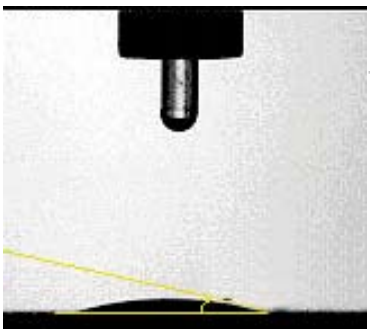
Fig. Low contact angle = hydrophilic fabric

Increased functionality for diagnostics

Sefar fabrics can be modified by plasma activation or wet chemical procedures to achieve specifically functionalised surfaces. Functional groups such as amino and carboxy enhance the binding of antigens (or antibodies) onto the fabrics surface. Additional, spacer moluecules may be bound onto the functionalised fabric surfaces. Spacer molecules, which may be of various length, facilitate the oriented immobilisation (3-D) of antigens (or antibodies) onto the fabrics surface.

Fig. Image of a water drop on a hydrophilic fabric during contact angle measurement

(For additional information on diagnostic applications, please refer to our Sefar brochure «Solutions for the diagnostic industry»).



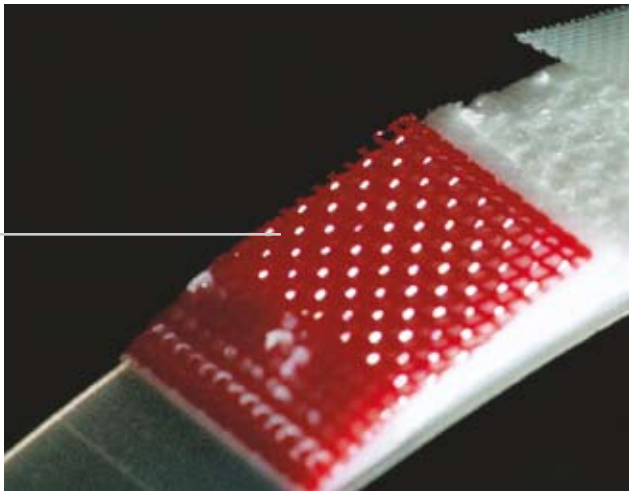


Fig. Diagnostic test strip with hydrophilic fabric

Excellent repellency against water and dirt

Sefar fabrics protect electronic equipment from dust, water and dirt
Woven filters are used in many acoustic devices, in loudspeakers and microphones. Sefar filters not only improve the speech and sound quality in mobile phones by adsorbing unwanted frequency peaks; they also protect the sensitive electronic equipment from moisture, dust and dirt. Hydrophobic surface treatments offer an excellent protection against moisture uptake and contamination.
Sefar's acoustic fabrics are hydrophobically treated to provide optimal protection against moisture uptake and to repel dust and dirt. Hydrophobic fabrics are also available in black or customer specific colors.

(For additional information please see our brochure «Mobile phones».)

Sefar's hydrophobic woven fabrics protect loudspeakers and microphones from moisture, dust and dirt

Fig. Mobile phone with loudspeakers and microphones

Sefar fabrics improve filtration performance of fuel filters

In automobiles, a series of filter systems are used to protect sensitive components. Sefar's high precision woven fabrics are mounted in the fuel, injection and hydraulic filter systems.
Since the fuel can be contaminated with particles and dirt originating from refining, transport, and storage, from the filling process or from simply the automobile tank itself, a series of security filters are installed along the fuel transport path. These filters, from the tank to the injector system, protect the mechanical parts from damage and prevent the injection nozzles from blocking. In addition, high water content is usually found in fuels, especially in diesel, which has to be removed as it may lead to corrosion.
In order to enhance water removal, the fabrics used in fuel systems should be hydrophobic.

(For additional information see our brochure: Automotive solutions.)

Fig. Diesel water removal filter

SEFAR

Sefar fabrics remove water from kerosene and other fuels

Airplane carry thousands of liters of fuel which must be free of particles and water to guarantee trouble-free operation of the jet engines. Jet fuel does contain a certain amount of dissolved (approx. 60 parts per million [ppm], ca. 60 micrograms per one kilogram of kerosene) – and free water that must be removed to prevent freezing and blocking of the fuel transport system.

Coalescer systems are used in the removal of water from jet fuel and others (e.g. diesel). Water droplets combine at the coalescer surface (filter medium) to form drops which – by flow and/or gravity – move to a separator. The fuel then flows through the separator while the water drops are retained by the hydrophobic filter.
The surface of the separator consists of a hydrophobic woven filter medium supported by a stainless steel element.

SEFAR PETEX® and NITEX® filter fabrics are designed and manufactured to fulfill the demanding requirements of the aerospace industry. Since the fabric has to retain water, it must be hydrophobised either by a wet chemical process or by plasma polymerisation.

(For additional information, please see «Customer information Nr. 6: Filter components for the aerospace industry»)

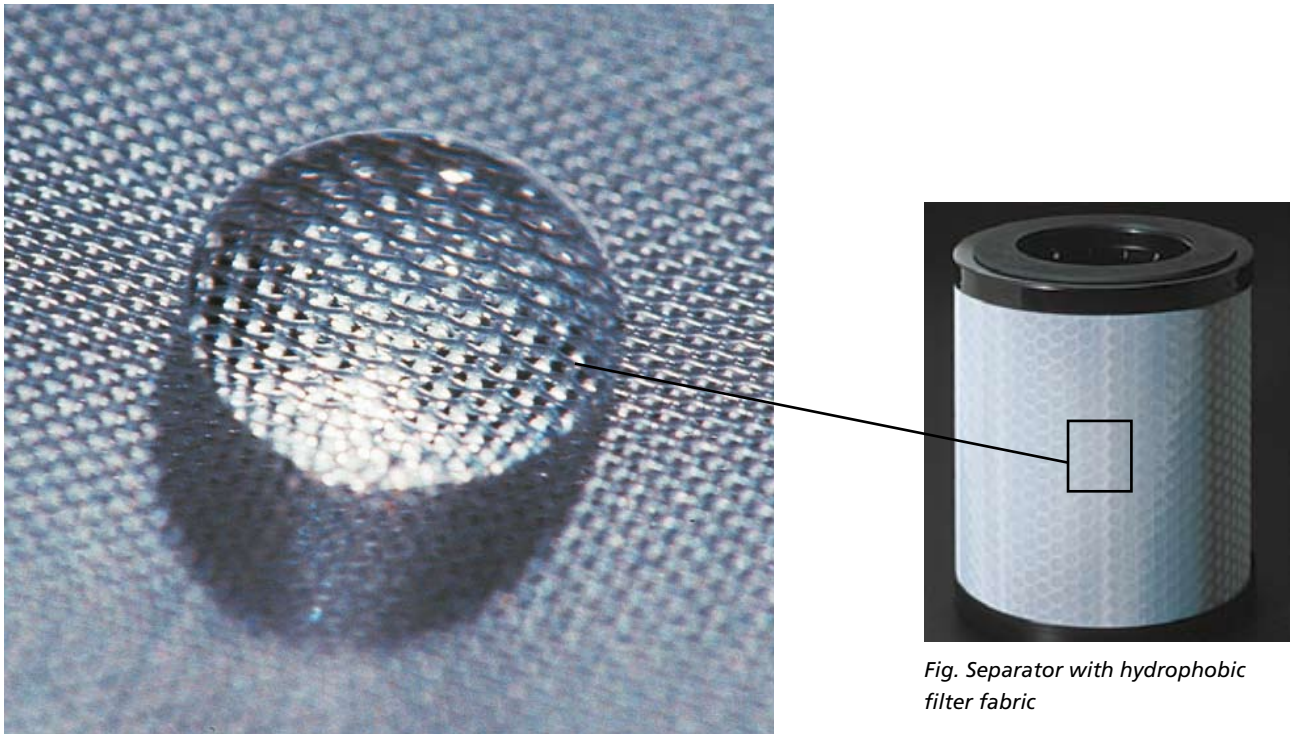


Fig. Separator with hydrophobic filter fabric

Highly effective shielding and conductive properties

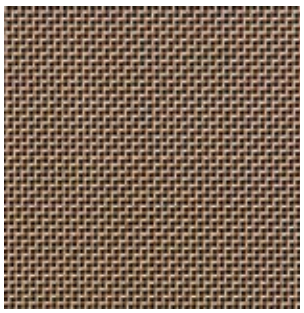
Sefar's conductive fabrics prevent charge build-up and shield electronic equipment
Conductive fabrics prevent charge build up, shield cables, gaskets, visual displays and instrument panels, provide architectural shielding, lightning strike protection and electric grounding. Shielding materials are widely used to protect humans from electromagnetic waves. Sefar fabrics can be supplied with a metallic coating which improves charge dissipation and shielding. Metalised woven fa brics effectively shield electro-magnetic waves.

Sefar offers various metalised polyester and polyamide fabrics: copper-, nickel and aluminum coatings are available. Additional metallic coatings can be done upon customer request.

(For additional information on shielding applications, please refer to «Customer information Nr. 5: Sefar solutions for mobile phones»)

EMI effectiveness of SEFAR® METALEN

SEFAR® METALEN fabrics have been evaluated for the shielding effectiveness at an external laboratorium. The shielding effectiveness from 1 to 10 GHz has been investigated. The results show that a shielding effectiveness of 50 dB provides a 99.999 % attenuation of the electromagnetic radiation and even a 40 dB effectiveness provides a 99.99 % attenuation. SEFAR® METALEN fabric typically exhibit shielding effectiveness greater than 40 and 50 dB between 1-5 GHz and 6-10 GHz, respectively (see figure).



Copper coated fabric

Nickel coated fabric

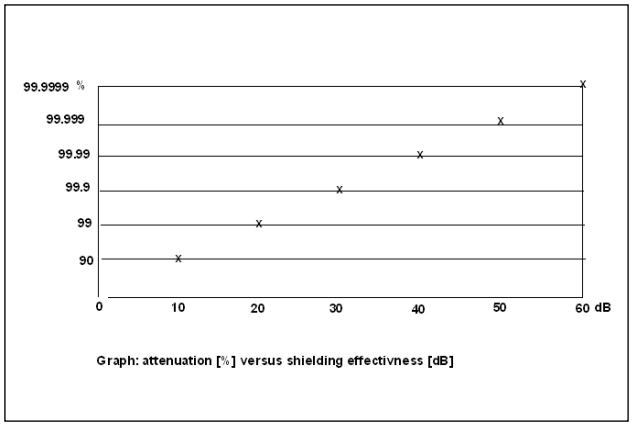


Fig. Shielding effectivness dB

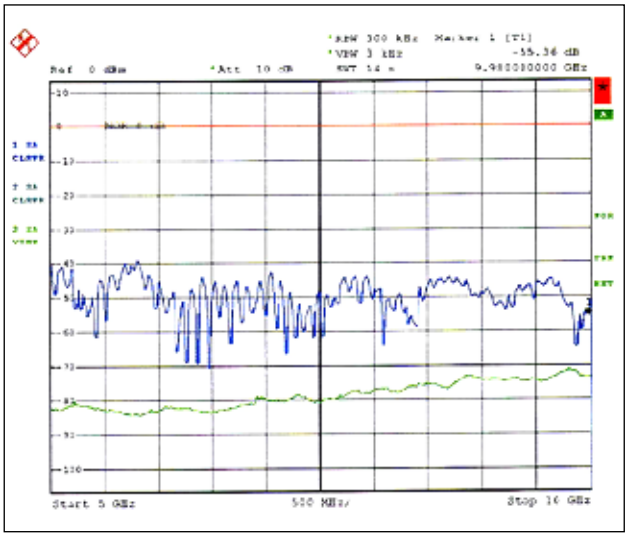


Fig. EMI effectiveness of SEFAR® METALEN 07-115/36 CU, 5-10 GHz

Increased bonding

Sefar fabrics are used as a mechanical grid for membranes
Membranes are used in a wide variety of applications; from analytical sample preparation to healthcare -, microbiology and industrial filtration. Due to their structure (only 20% solid material, weak cell walls) membranes are very brittle and therefore often need

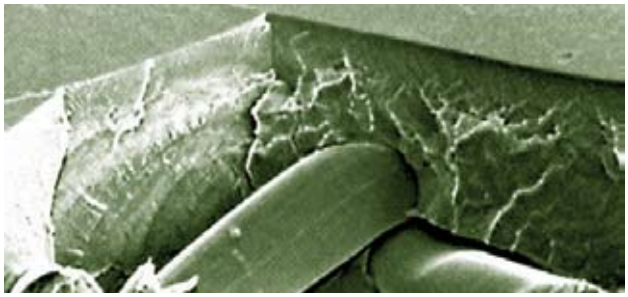


Fig. Sefar fabric embedded into a membrane

a support material so that they become more stable and can be handled easily. The support material is part of the membrane: During production the membrane mass is usually cast into the support material so that the support fabric is covered completely by the membrane material. The material for the support fabric depends on the membrane mass itself and on the working environment.
In order to enhance the adhesion between membrane mass and support fabric, the latter's surface can be modified by a plasma treatment. This is especially important when the chemical nature of the membrane mass and the support differ significantly from each other. Plasma treatments have proven to significantly enhance the bonding between the membrane material and the support fabric.

Generally; all open mesh fabrics may be used as membrane support. High open fabric area is beneficial.

Pre-treatment for bonding fabrics to other surfaces
Adhesive bonding of polymers is being utilized more and more as a structural joining method in variety of manufacturing processes as for example in aerospace, automotive and healthcare industries. Polymers with low surface energy and chemical inertness such as polyolefins (e.g. PE, PP) and fluorcarbons (e.g. PTFE, PVDF) – and to some lesser extent polyamides, polyesters, polyetheretherketone – are very resistant to adhesive bonding and therefore require plasma pre-treating.

In order to enhance the bonding behavior of these polymers, their surface characteristics (surface energy, -topography) have to be altered. This may be achieved by various methods such as e.g. mechanical abrasion (grinding), flame treatment, wet chemical- and plasma etching, plasma-/ corona- and UV activation, etc.

Generally, all Sefar fabrics can be pretreated for improved adhesive bonding.

Since most of the wet-chemical coatings are not tightly adhered to the polymer's surface, there is a risk that the bonding too will not be very strong. Due to the fact that plasma treatment, which has a low negative impact to the environment, directly acts on the fabrics surface and so effects stronger bonding, plasma etching/treatment will be the method of choice.

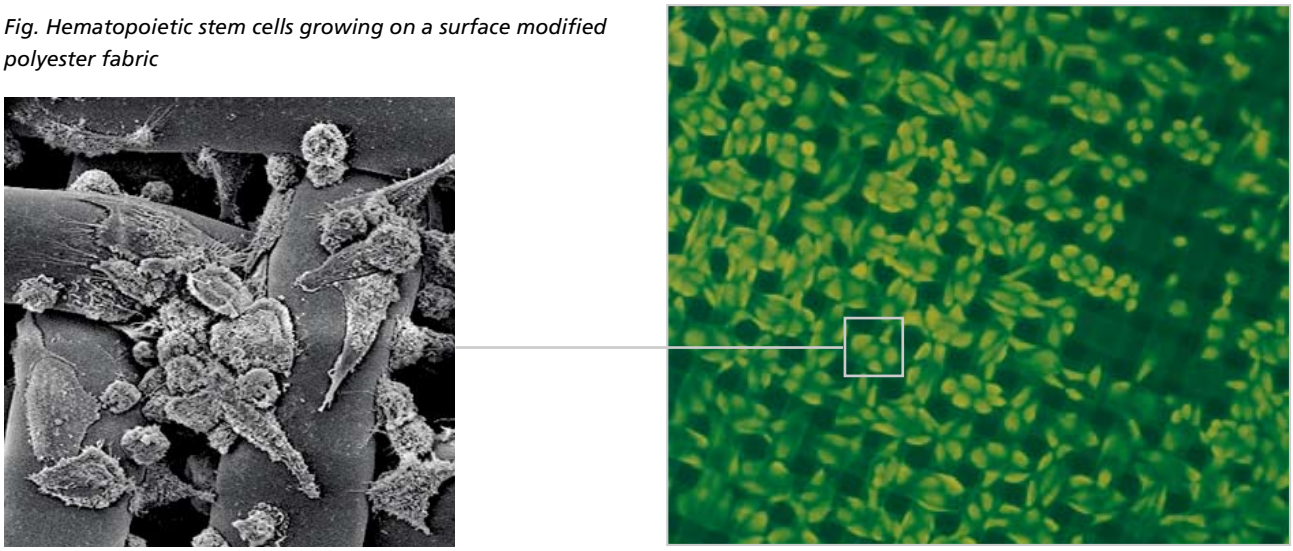
Sefar functionalised fabrics are used as cell cultivation media

Sefar woven fabrics are becoming increasingly integrated into cell cultivation procedures, where the corresponding cells/cell lines have to be proliferated. In these cases, the fabrics monofilament yarns serve as «halt» where the cells attach to. The selection of the best-suited fabric depends more on the yarn curvature than on the fabric's construction (mesh width open area) or geometry. In order to enhance (or inhibit) cell adhesion, the fabrics may be modified by adding functionalised chemical groups onto the yarn surface. The chemical groups mainly include the following: amino (-NH2), hydroxy (-OH), carboxy (-COOH) and carbonyl (-CHO), respectively. As cells /cell lines are very sensitive to the chemicals used for wet chemical surface modifications, plasma technology is the coating method of choice.

In the past, various cells such as fibroblasts, leukocytes, chondrocytes, hepatocytes, hematopoietic stem cells, etc. have been successfully cultivated on Sefar's fabrics.

Typical fabrics used for cell cultures include the whole range of SEFAR MEDIFAB® fabrics.

Fig. Hematopoietic stem cells growing on a surface modified polyester fabric



Sefar Headquarter

Sefar AG
Filtration Solutions
Hinterbissaustrasse 12
P.O. Box
CH-9410 Heiden – Switzerland
Phone +41 71 898 57 00
Fax +41 71 898 57 21
filtration@sefar.com

Sefar Filtration Subsidiaries

Sefar Filtration Inc.
Buffalo, Depew, NY – USA
Phone +1 877 481 3626
filtration@sefar.us

Los Angeles, CA – USA
Toll Free +1 800 401 3367
hfsales@sefar.us

Sefar BDH
Chicoutimi – Canada
Phone +1 418 690 0888
julie.lapointe@sefar.com

Sefar Filtration de México, S.A. de C.V.
Iztapalapa, D.F. – Mexico
Phone +52 55 2291-0652/5612-7696
info.mexico@sefar.com

Sefar Tenyl
Tenyl Tecidos Técnicos Ltda.
Guarulhos, SP – Brazil
Phone +55 11 2137-1555
contato.brasil@sefar.com

Sefar Singapore Pte. Ltd.
Asia Pacific Headquarter (Filtration)
Singapore
Phone +65 6 299 90 92
info.sg@sefar.com

Sefar Filtration Solutions (Suzhou) Ltd.
Jiangsu Province – China
Phone +86 512 62836383
sefar@sefar.cn

Sefar Singapore Pte. Ltd.
Indonesia Rep. Office (Filtration)
Jakarta Barat – Indonesia
Phone +62 21 5890 2065/66/68
sefarind@indosat.net.id

Sefar Filter Specialists Pty Ltd.
Huntingwood, NSW – Australia
Toll free phone 1300 306 661
sfs@sefar.com.au

Sefar Filter Specialists Pty Ltd.
Auckland – New Zealand
Phone +64 (0) 9622 3330
david.fleming@sefar.co.nz
Sefar Filtration (India) Private Ltd.
Maharashtra – India
Phone +91 22 25862302/03/04
ramanathan.krishnan@sefar.com

Sefar Fyltis S.A.S.
Lyon Cedex – France
Phone +33 472 13 14 15
vente@sefar-fyltis.fr

Sefar Italia S.r. l.
Collegno-Torino – Italy
Phone +39 011 42001
info@sefar.it

Sefar Maissa S.A.
Cardedeu – Spain
Phone +34 9 3844 4710
sefarmaissa@ilimit.es

Sefar GmbH
Wasserburg/Inn – Germany
Phone +49 8071 90400-0
info@sefar.de

Sefar B.V.
Goor – Netherlands
Phone +31 547 26 28 26
info@sefar.nl

Sefar Ltd.
Bury, Lancs – England
Phone +44 (0)870 1010140
sales@sefar.co.uk

3105-0102/100/12.2008