
Sustainable Textile Technology
for High-Performance
Water-Repellency
BARRIER
WATER-REPELLENT
Stay Dry –
Ecologically

Introduction

HeiQ is a Swiss specialty textile effects company with 30 employees, 15 nationalities, in 7 countries on 4 continents

HeiQ was founded in 2005 as Spin-off of the Swiss Federal Institute of Technology (ETH)

HeiQ offers innovation R&D, customized manufacturing and ingredient branding in one

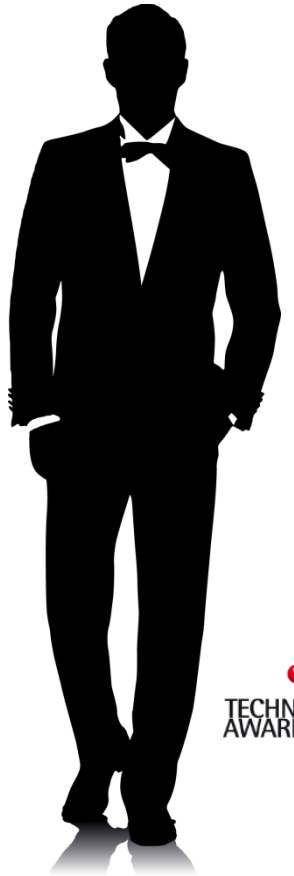
HeiQ promotes the product families:

ADAPTIVE
DYNAMIC COOLING

PURE
NATURALLY FRESH

BARRIER
WATER-REPELLENT

GLIDER
MOVE FREE



SWISS TECHNOLOGY AWARD

HeiQ's Global Presence

Serving you around the clock!

HeiQ Entrepreneurial Spirit

2013	Finalist Swiss of the Year
2011	European Environmental Press Award
2010	Swiss Technology Award
2010	Swiss Equity Fair Winner
2009	Finalist E&Y Entrepreneur Of the Year
2008	KTI Technology Entrepreneur
2007	McKinsey / ETH Venture Prize
2007	Venture Leaders Award
2006	W.A. DeVigier Foundation Award
2006	IMD Startup Award
2005	Siska-Heuberger Prize

SWISS TECHNOLOGY AWARD

venturelab
FAST TRACK FOR START-UPS

spinoff ETH zürich

Repellency Revisited

- Durable Water Repellency (DWR) is an essential feature of outdoor apparel
- DWR apparel today faces many challenges:
    - Fluorine phase-out
    - NGO campaigns
    - Comfort limitations
- Time to revisit assumptions behind DWR
- Opportunity to gain market share with fresh approaches

Challenges

- Systematic elimination of fluorinated polymers, and telomer surfactants use in textiles. Concern over environmental and health impacts. Potential for bioaccumulation and mammalian toxicity from manufacturing by-products:
    - PFOA perfluorooctanoic acid
    - PFOS perfluorooctane sulfonate

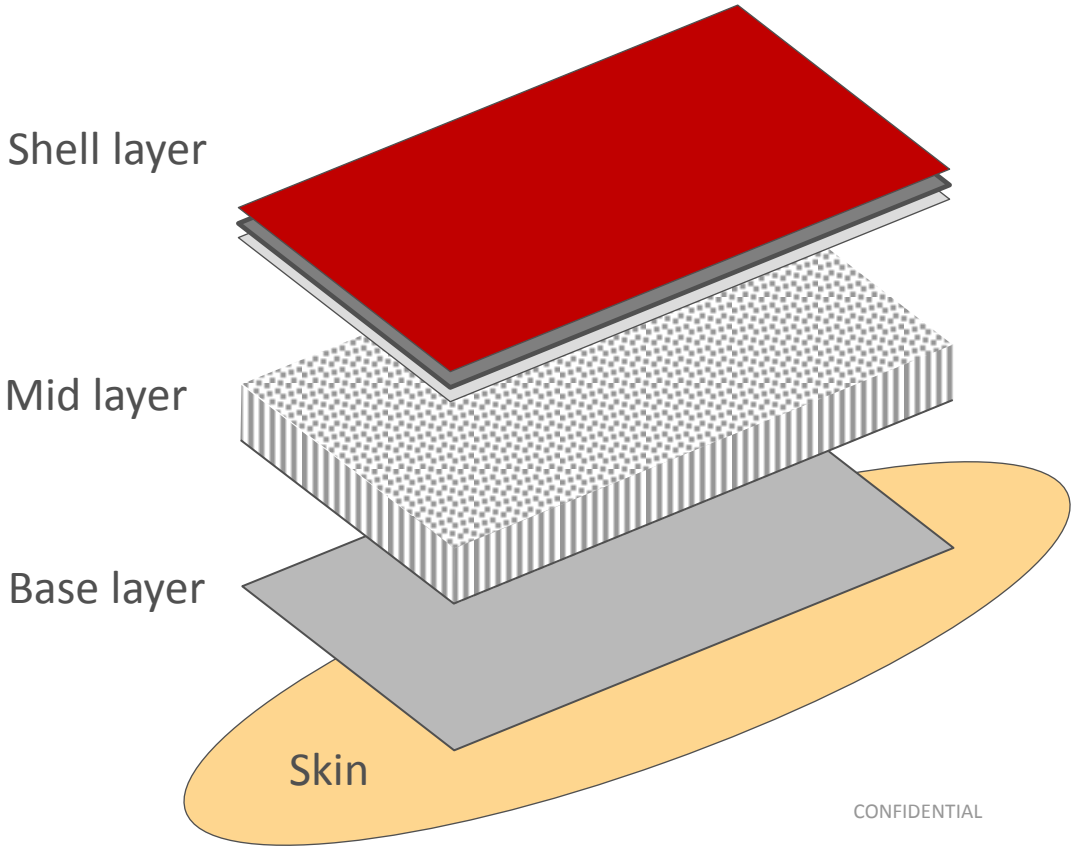
- Regulatory actions have been rapid and strong:
    - US EPA: Phase out of PFOA and PFOS fluorinated substances by 2015
    - EU: PFOS banned since 2008, PFOA is a candidate for SVHC (REACH)

- NGO campaigns: Overwhelming pressure for brands to specify fluorine-free treatments.

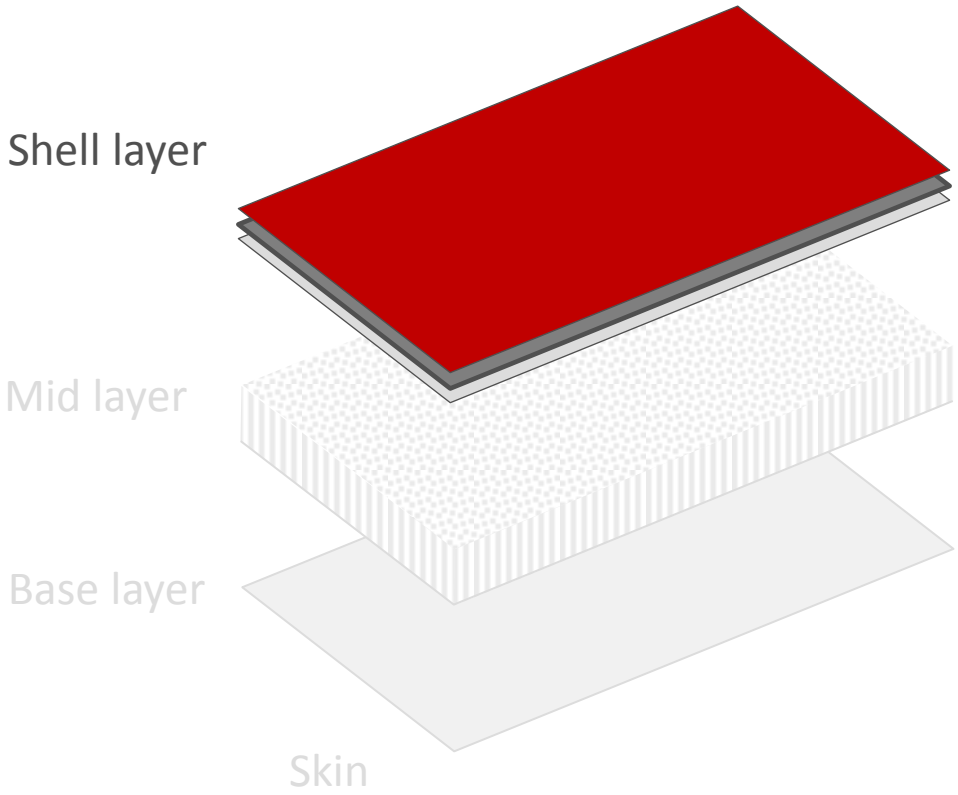
- C8 based fluorinated chemistry is already being supplanted in the market

- Alternatives?
    - C6 fluorinated products – less effective, more expensive, still fluorine
    - **Fluorine-free products** – ***limited range of alternatives and open for innovation…***

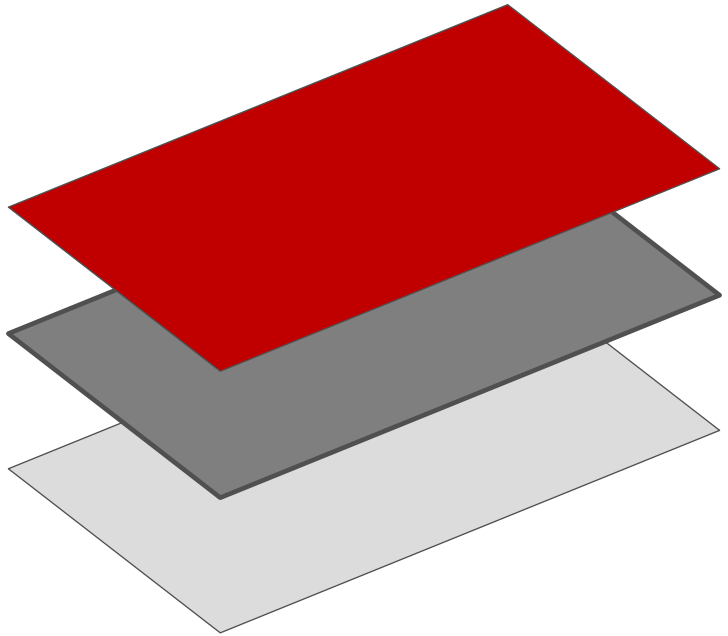
DWR conventions



DWR conventions



DWR conventions



Woven Fabric

Membrane or Coating

Charmeuse/ scrim

PA/PES/Lycra with C8 or C6 fluorochemical treatment

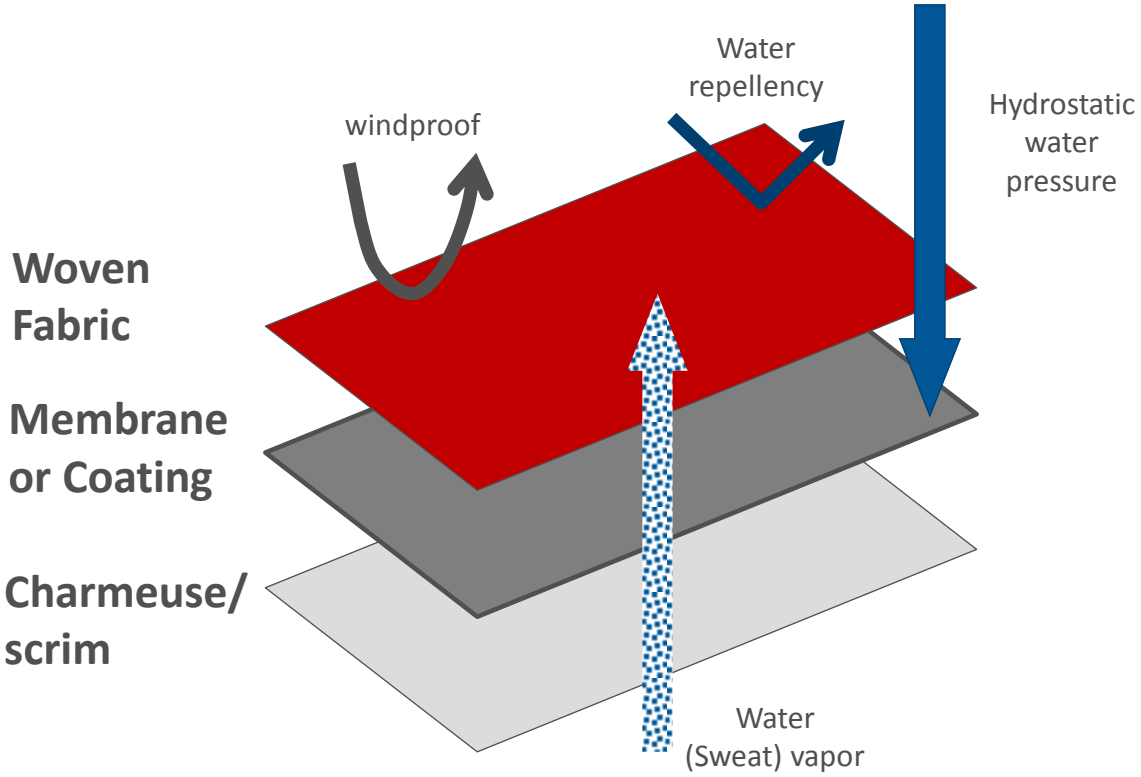
Fluorine PTFE
PU
PET
PA

or

Solvent-based PU coating

PA
PES

DWR conventions



Water repellency

- Spray test — AATCC 22
- Bundesman — ISO 9865

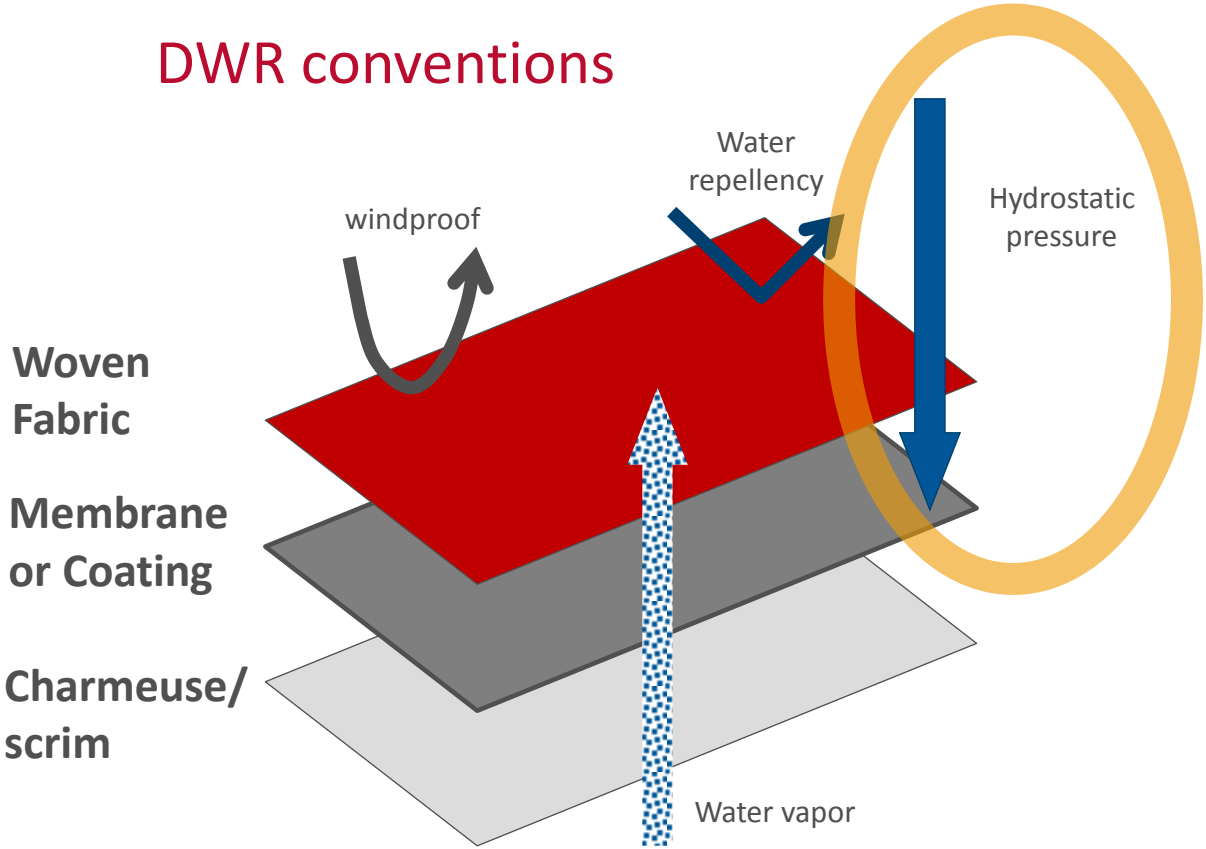
Hydrostatic water pressure test

- Water column test — eg. ISO 811

Water vapor permeability

- Vapor transmission — eg. ASTM E 96

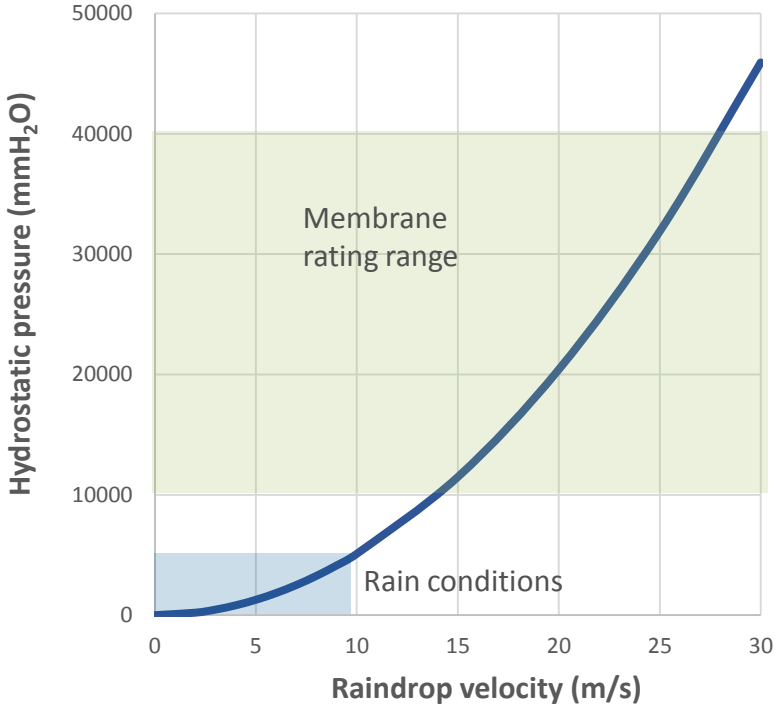
DWR conventions



DWR – Hydrostatic Pressure

- Pressure rating in mmH_2O ('water column')
- Natural pressure from falling raindrops:
  - Up to 5000 mmH_2O
- Typical membrane specs:
  - 10000 through 40000 mmH_2O

High specification of hydrostatic pressure can hinder breathability



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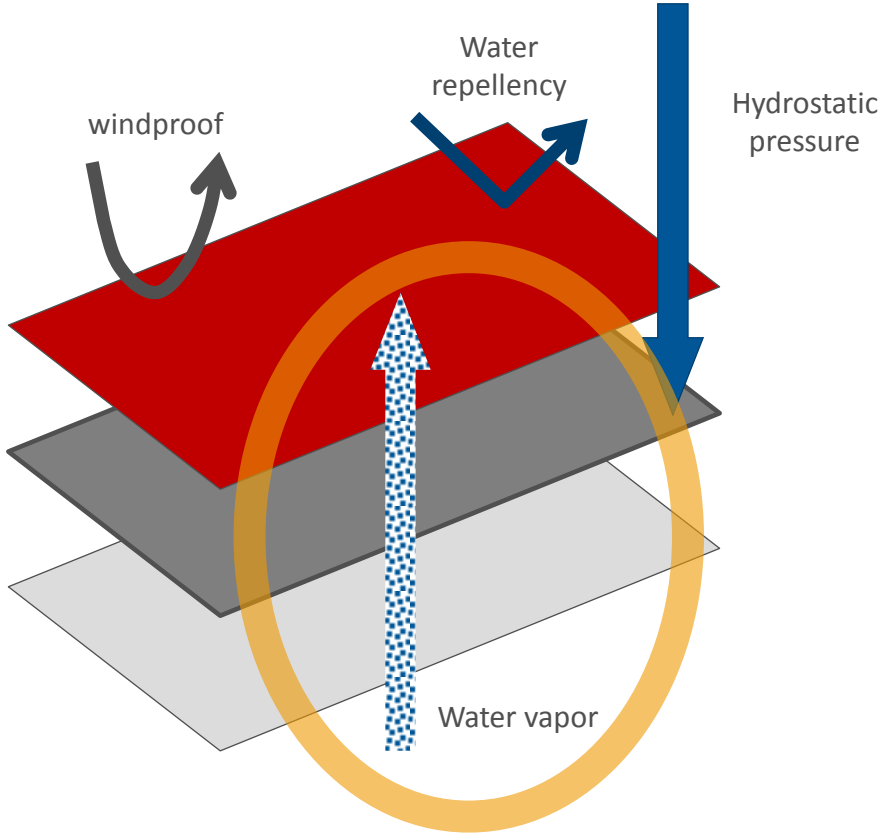
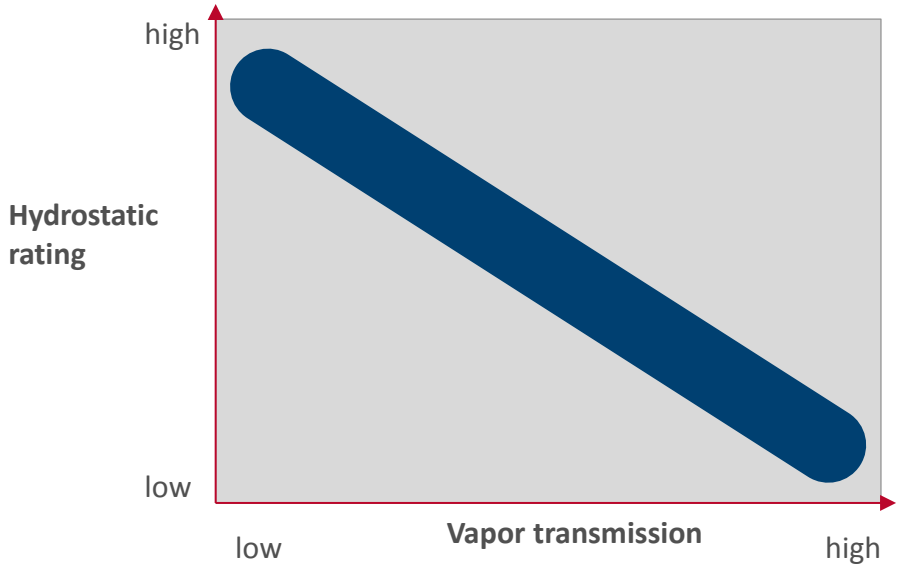


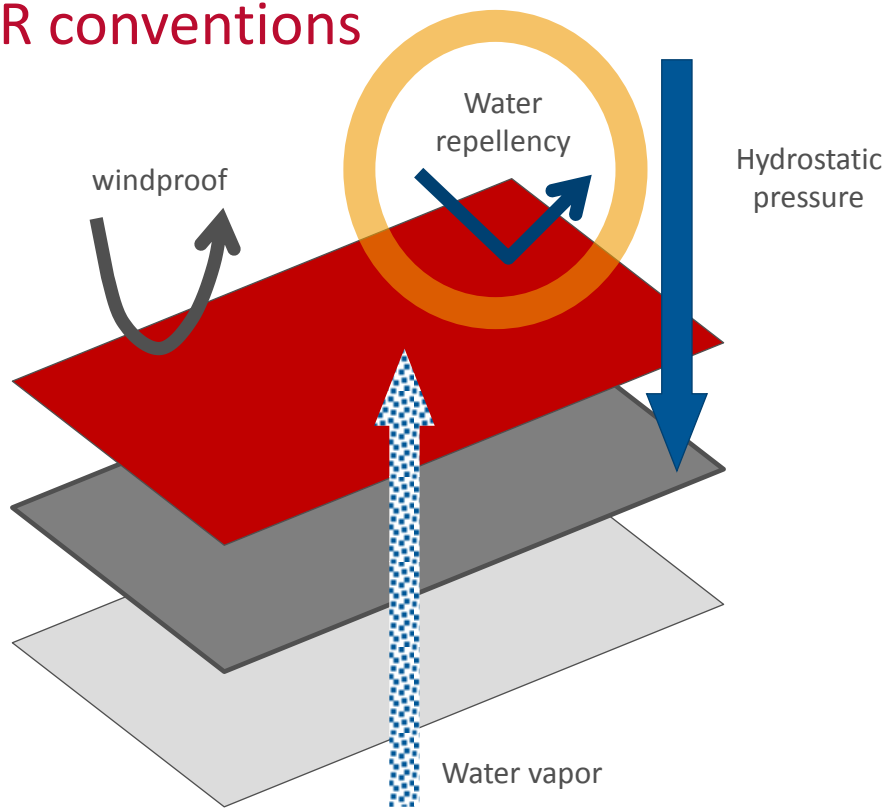
DWR – Breathability

- Human sweat rates
  - Up to 1L/h with intense activity
  - Up to ca. 12000 g/m^2/24hrs
- Typical spec range:
  - 3000 – 9000 g/m^2/24hrs
  - Desiccant methods



Balance between membrane composition, thickness and porosity required to achieve desired hydrostatic and breathability properties

DWR conventions

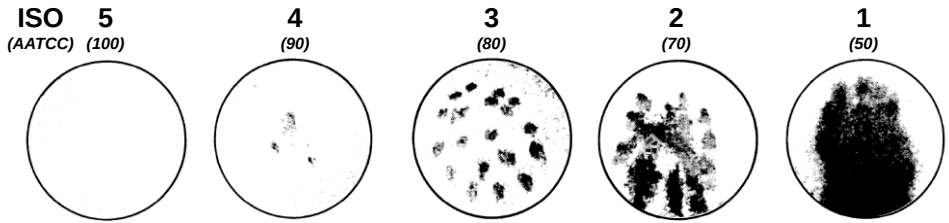


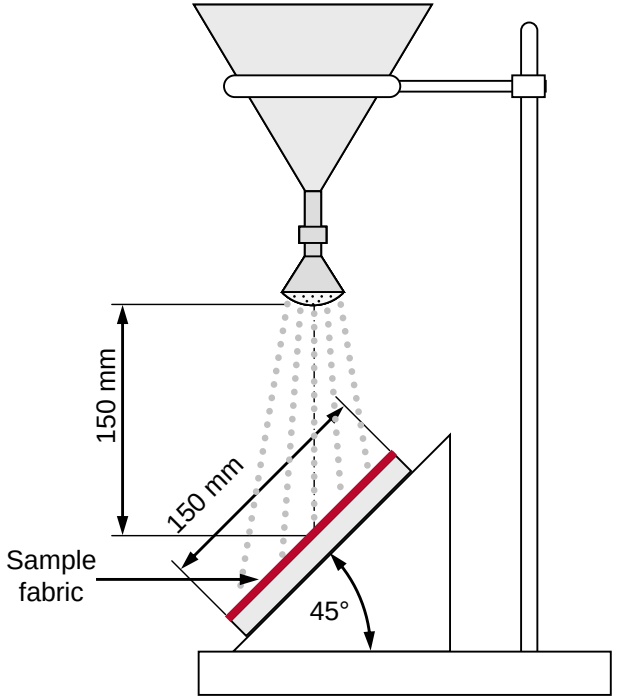
Repellency Test Methods: Spray Test

250ml of water is uniformly sprayed on a fabric specimen mounted at an angle of 45°

The Spray rating is determined by comparing fabric appearance with descriptive and photographic standards

Very Good performance if 100/100 after 20 Home Laundries





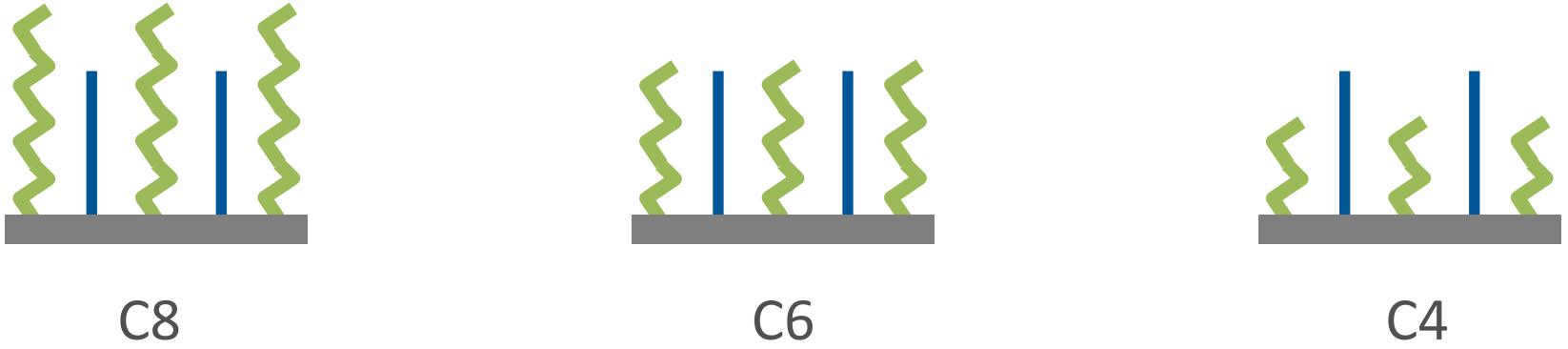
ISO 4920/AATCC 22 method:
Spray test equipment configuration

DWR – Water repellency

- Padding treatment of woven top-layer
- Chemistry choices:

Fluorine	Fluorine-Free
C8	Paraffin
C6	Silicone
C4	PU (Barrier ECO)

Fluorine polymers up close



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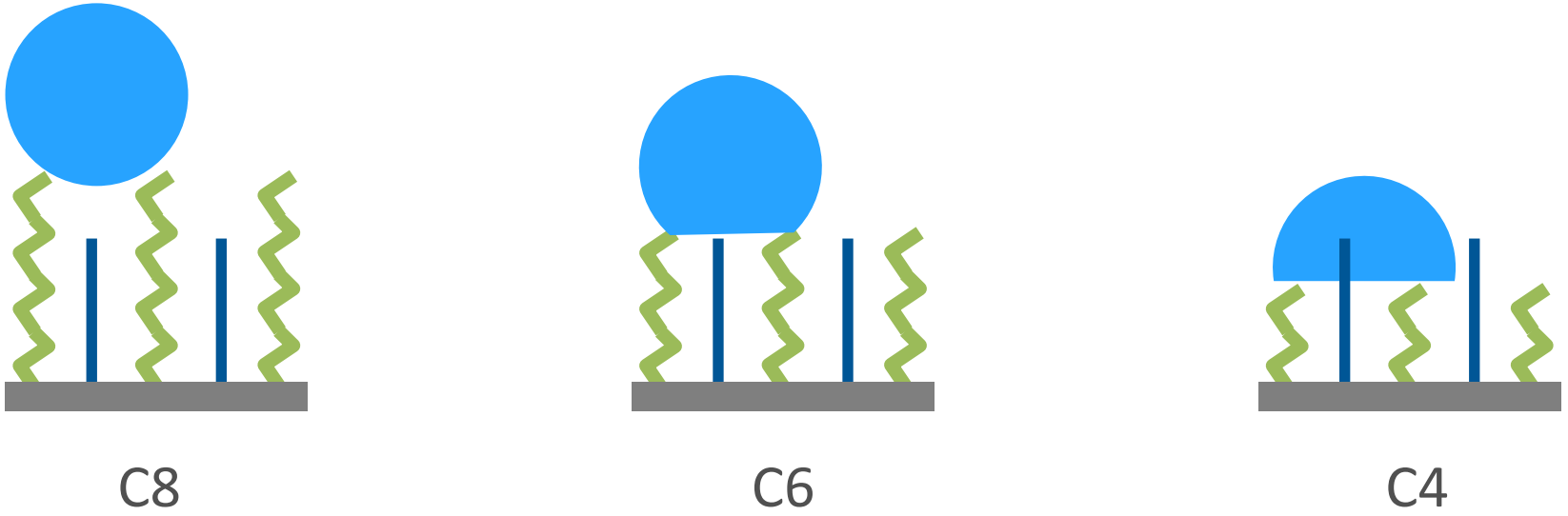

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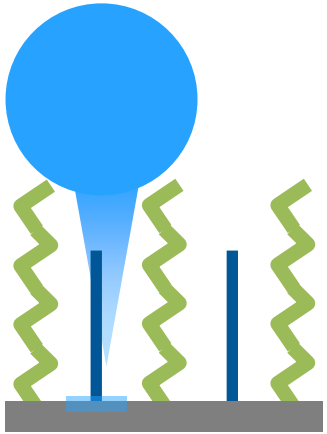
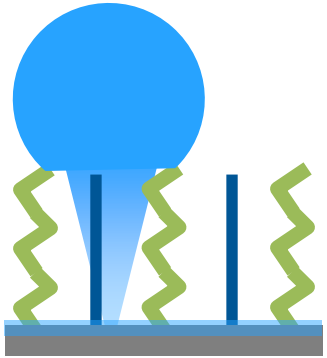
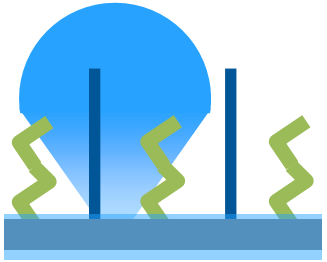


C8

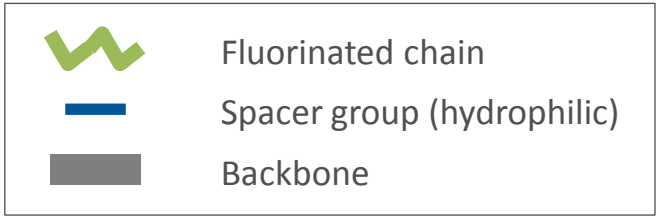


C6



C4

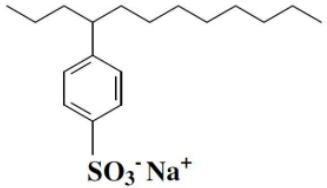
Typical for C4 is a saturation of the backbone with water after a short time. Strong Laundry Air Dry (LAD) effect



Testing F-free treatments

- Home laundry cycles are a key part of assessing performance...
- Caution! -- Detergent components may interact with fluorine free films
  - Hydrophilic residues may be retained on surface

Surface residues



- Detergent interaction is not relevant for conventional fluorinated treatments
- Consequences for testing fluorine vs F-free:
  - **Choice of washing settings (quantity and type of detergent)**
  - **Role of post wash rinsing to remove detergents**
  - **Care recommendations (reduced detergent use during care phase)**

What is really needed?

What functions do people want from repellency garments?

- **Dry**: Stay dry in the rain (DWR)
- **Breathability**: Do not get wet from own perspiration and condensation
- **Fit**: Flexible, light to wear
- **ECO:** Low footprint chemistry

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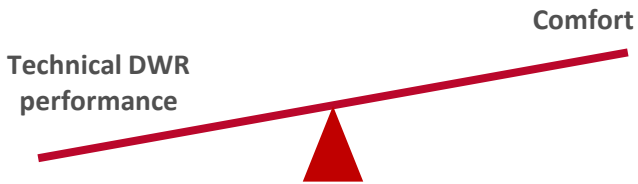
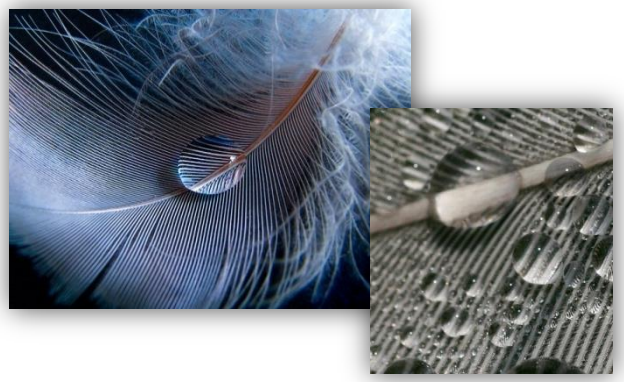



The original
Fluorine free…

How does a duck stay dry without fluorine?



“It’s like water off a duck’s back…”

Ducks stay dry – even during rain.
Feathers are naturally extremely water-repellent

Their secret lies in a fatty secretion and in numerous linked 3D micro feather strands possessing a very small contact surface

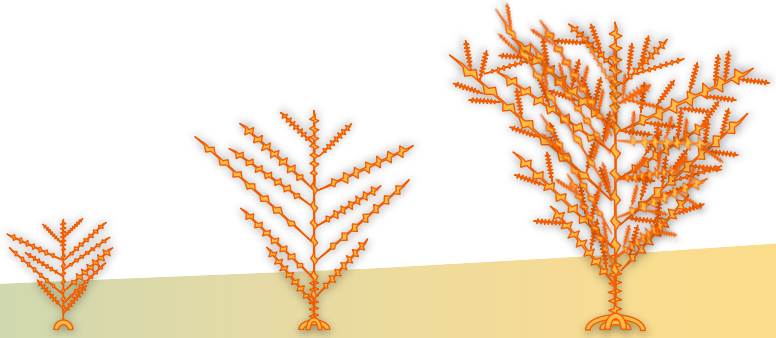
How can garments stay durably dry without fluorine?

HeiQ Barrier Eco – a hydrophobic textile effect providing durable water-repellent performance with the help of special 3D hyper-branched polymers

Bio-Inspiration – Water-Repellency with Hyper-Branchery

HeiQ Barrier Eco imitates the efficiency of a duck's feathery coat – water repellency completely free of fluorocarbon

Its technology mechanism lies in 3-dimensional hyper-branched polyurethane polymers – comparable to multi-branched corals:



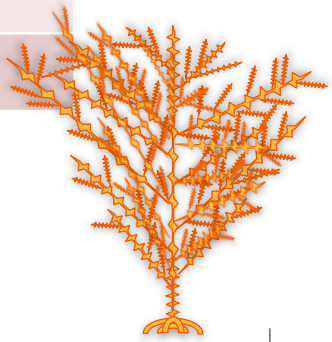
BARRIER

HeiQ innovation

- New fluorine-free treatments

- DWR treatments mostly emphasize chemistry. However, effective repellency is best achieved through chemistry + structure…

Fluorine-Free	Chemical repellency	Structure repellency
Paraffin	✓	✗
Silicone	✓	✗
PU (Barrier ECO)	✓	✓



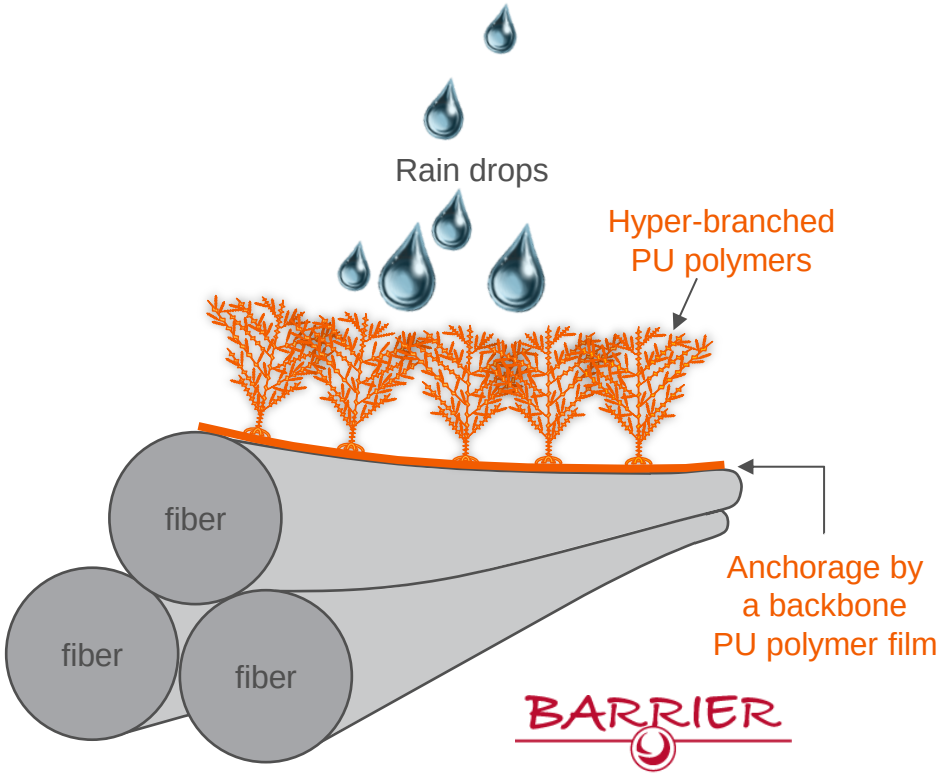
Fluorine-Free by HeiQ: Barrier ECO

Hydrophobic, hyper-branched polyurethane polymers with a large number of functional branches

Self-assembling polymer technology with rapid crystallization

Maximum anchorage to textile fibers thanks to the formation of a durable polyurethane backbone polymer film

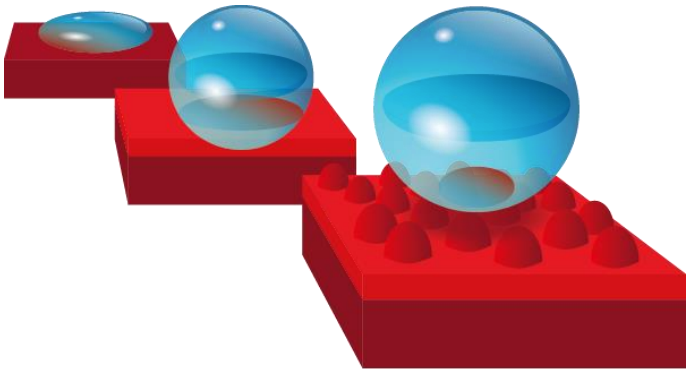
Building a 3D surface structure to provide enhanced water repellency



Product Description – HeiQ Barrier ECO

HeiQ Barrier ECO is a topical textile treatment typically applied by padding (30-80 g/l)

Suitable for all types of textile fibers



HeiQ Barrier ECO provides garments with durable water-repellent properties while maintaining important textile parameters such as color-fastness, pilling and snagging properties

Repellency Effects Compared

	Ecological Water Repellent	High-performance Oil & Water Repellent	Ecological Oil & Water Repellent
	HeiQ Barrier ECO	C8-fluorocarbons	C6-fluorocarbons
Basis	Hydrocarbon polymer (hyper-branch structure)	Fluorocarbon polymer (C8 components)	Fluorocarbon polymer (C6 components)
Contains Fluorine	**No**	Yes	Yes
PFOA residues	**No**	Traces (< 40ppb)	No
Water repellency (spray)	++	+++	++
Water repellency (rain)	++	+++	++
Oil repellency	*	+++	++
Durability (laundry)	++	+++	++
Durability (abrasion)	+++	++	++
Handle impact	Low	Medium/High	Medium

* Oil repellency is only possible with fluorine-based products.

Ecological Footprint

- No fluorine: no PFOS, no PFOA
- No formaldehyde
- No waste water burden
- No organic halogen compounds
- No water toxicity
- No oral toxicity
- No AOX value

HeiQ Barrier ECO

Fluoro-free & performance

Working with HeiQ Barrier ECO

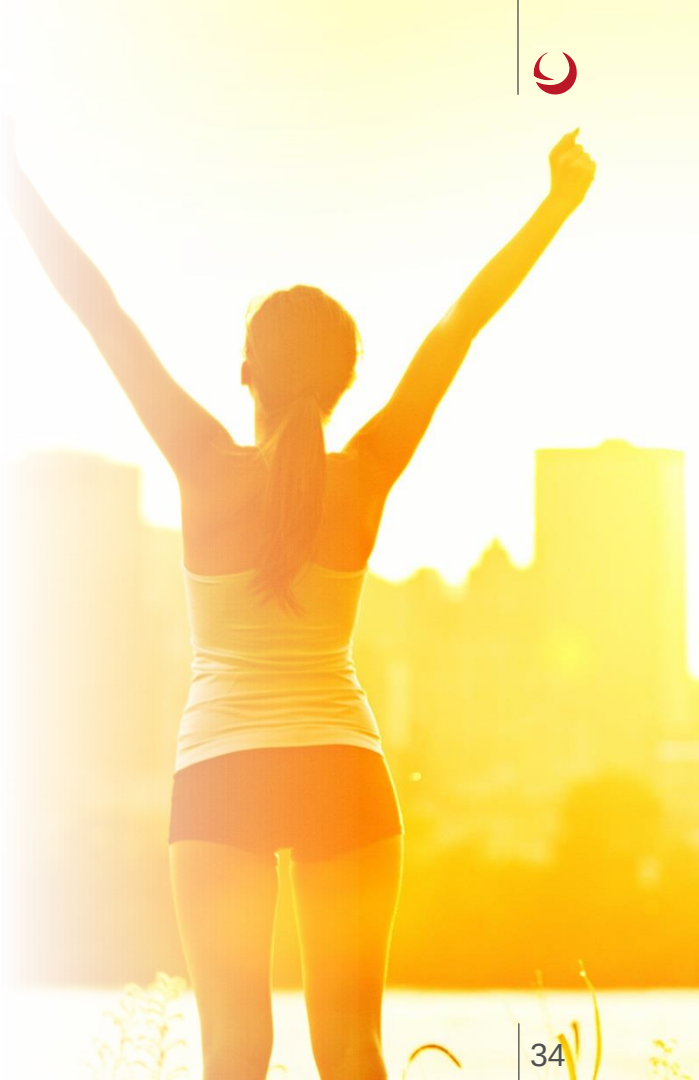
- Durable water repellent treatment – highest wash durability with complementary binder system
- Strong abrasion resistance
- Perceptible soft handle
- No compromise on breathability due to paraffin free technology
- Good laundry-air-dry (LAD) behavior
- Complies to EU REACH
- bluesign approved
- Oekotex conform


Boost your
Communication!
Consumers Buy Innovation Stories –
HeiQ Creates Them Together With You

HeiQ’s Marketing Support

With our Marketing Support our goal is to:

- Help you to sell more
- Help you to sell at a higher margin
- Help you to differentiate from your competitors



Video Hangtag – Gateway to Consumer at POS

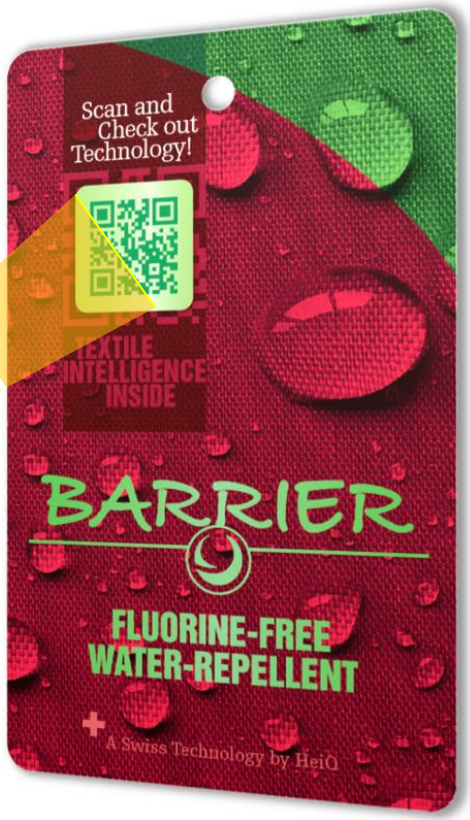
Your direct end-consumer-communication at POS

- Added value
- Information
- Identification
- Complementing sales staff

Capture consumer interest &
win consumer trust

QR code links to Technology
Video and more information
→ Online Experience

Scan QR code with one of the following
Apps on your smartphone, e.g.:



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Repellency Revisited

HeiQ building fresh tools to help redefine DWR:

- 100% Fluorine-free
- Rain resistance & breathability
- Light weight & comfort

Thank You For Your Interest

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HeiQ Materials AG - Develops and manufactures high-performance textile effects. End-to-end offering including innovative product development, analytics and validation, custom manufacturing, sales, marketing and regulatory affairs support.