PLATFORM TECHNOLOGY BRIEFING

Unitary DPNR Janus Medical Membranes

Next-generation asymmetric bio-interfaces combining natural elastomeric resilience with zero-delamination IP.

Solving the trade-off between soft-tissue conformability, directional fluid control and hypoallergenic safety.

Deproteinized natural rubber · one membrane, two opposing faces



Current wound and surgical barriers force a costly compromise

Three failure modes keep showing up in the same products — and each one has the same root cause.

PAIN POINT 01

Delamination under motion

Laminated synthetic dressings — polyurethane, silicone and hydrogel stacks — peel, curl and come apart under wet cyclic strain on mobile joints and internal organs.

Glue lines fail where the body moves most.

PAIN POINT 02

Trauma and maceration

Standard hydrophobic films trap exudate against the wound and tear fragile granulating tissue on removal, driving readmissions and cost of care.

Fluid sits where it should be leaving.

PAIN POINT 03

The natural rubber paradox

Natural cis-1,4-polyisoprene gives unmatched elasticity and soft-tissue compliance — but legacy latex carries Type I allergen risk and has no directional surface function.

The best elastomer, with the worst reputation.

THE ROOT CAUSE

To get two different surfaces, the industry glues two different materials together.

Every glue line is a failure plane, extra thickness and extra stiffness.



IN PLAIN TERMS Today's dressings are sandwiches. Sandwiches come apart when they get wet and bend — and that is exactly what a dressing has to do.

One monolithic elastomer. Two opposing bio-interfaces.

We engineer DPNR into a single, non-laminated membrane with a covalently anchored through-thickness gradient.



TISSUE-FACING SURFACE

Hydrophilic (WCA 20°–50°), anti-fouling and atraumatic — it manages exudate gently, or prevents post-surgical organ adhesions.

EXTERNAL / PARIETAL SURFACE

Hydrophobic (WCA ≥ 95°), a tough barrier against microbes and fluid ingress — or, used internally, a face that promotes sutureless tissue integration.

< 50 µg/g	≥ 35°	0%	0.5–3.0 MPa
extractable protein	**water-contact-angle gap**	**delamination**	**modulus**
ASTM D5712	between the two faces	at ≥ 200% biaxial strain	soft-tissue range

Design targets for the platform; Phase 1 benchtop work confirms them against the stated test methods.

IN PLAIN TERMS One sheet of purified natural rubber, built so that its two sides behave like two different materials — with nothing holding them together, because nothing has to.

Why we win

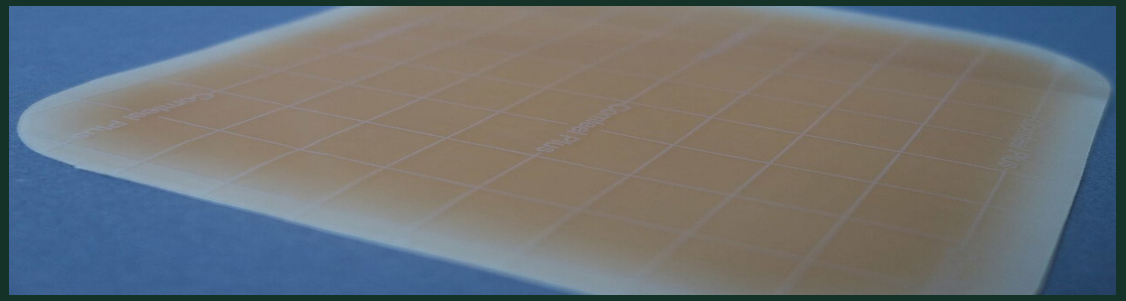
Three questions decide every evaluation: does it stay together, does it move, does it gate fluid.

	Laminated synthetic dressings	Standard isotropic DPNR films	Our unitary DPNR Janus membrane
Construction	Multi-layer adhesive bonds between PU, silicone and hydrogel plies	Single-matrix elastomer, but one chemistry throughout	**Monolithic single-matrix elastomer with a through-thickness gradient**
Interfacial integrity	Delaminates when hydrated and flexed	No seams — nothing to delaminate	**Zero interfacial seams; target 0% delamination at ≥ 200% biaxial strain**
Surface function	Two faces, but only by gluing two materials	Uniformly hydrophobic, ~85°–105° WCA — poor fluid gating	**Opposing faces in one phase; ΔWCA ≥ 35° target**
Tissue contact	Stiff modulus mismatch against soft tissue	Sticks to healing wounds	**Matches soft-tissue compliance, 0.5–3.0 MPa, > 90% elastic recovery**
Allergen profile	Synthetic, but accelerator and adhesive residues remain	Low allergenicity (DPNR)	**Low allergenicity plus accelerator-free cure options**

IN PLAIN TERMS Competitors either glue two materials together, or use one material that does only one job. We get both jobs out of one piece of material.

Two beachhead markets, one manufacturing platform

Wound care funds the company and de-risks the line; implantable barriers carry the margin.

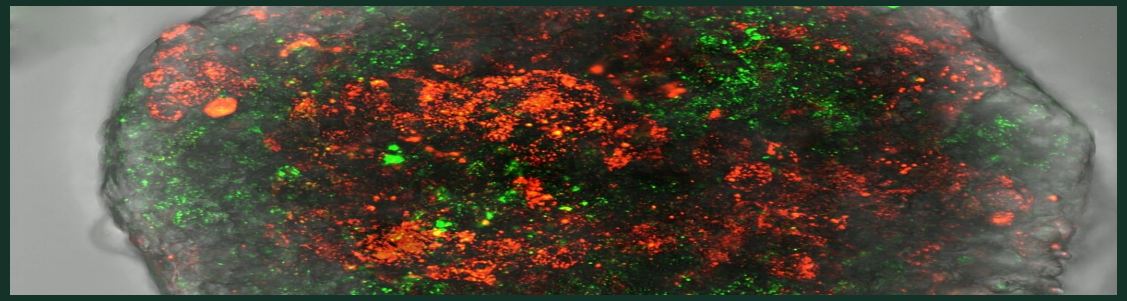


VERTICAL 1 · FASTEST PATH TO REVENUE

Advanced wound and burn care

Trauma-free, conformable dressings for chronic ulcers, burns and high-mobility joints, with directional moisture transport that keeps the wound bed right and the surrounding skin dry.

MVTR	800–2,500 g/m²/24 h, directional
Regulatory	510(k) pathway
Buyer	Wound-care converters and hospital systems



VERTICAL 2 · HIGH-MARGIN EXPANSION

Implantable anti-adhesion barriers

Ultra-low antigenic protein internal barriers that stop post-operative peritoneal and tendon adhesions on the visceral side while anchoring naturally on the parietal side.

Antigenic protein	< 10 µg/dm² (ASTM D6499)
Regulatory	PMA / 510(k) with animal data
Buyer	Surgical strategics

IN PLAIN TERMS The same machine makes both products. The first one is quicker to sell; the second one is worth far more per square metre.

Drop-in compatible with existing latex lines

No new factory. The asymmetry is created by how the film is formed and cured, not by adding layers.

1

DPNR feedstock

Abundant, renewable Hevea brasiliensis latex, deproteinized.

2

Cast or dip

Existing casting, dipping and roll-to-roll lines, unchanged.

3

Asymmetric cue

Unilateral UV or plasma grafting, or asymmetric cure density.

4

Lock the gradient

Covalently anchored through-thickness gradient.

5

Terminal sterilize

Gamma or EtO without losing the wettability gradient.

LOWER COGS

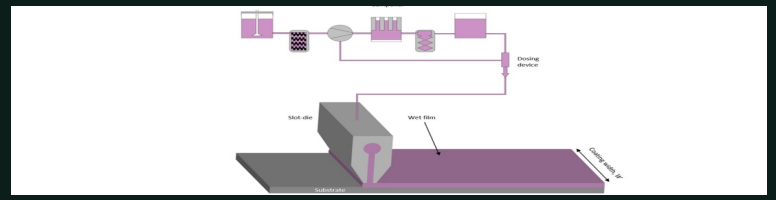
Eliminates multi-step lamination, tie-coats and solvent adhesives — fewer materials, fewer passes, less scrap.

RENEWABLE FEEDSTOCK

Hevea DPNR is abundant and agricultural, not petrochemical, and its supply chain already exists at scale.

STERILIZATION-SAFE

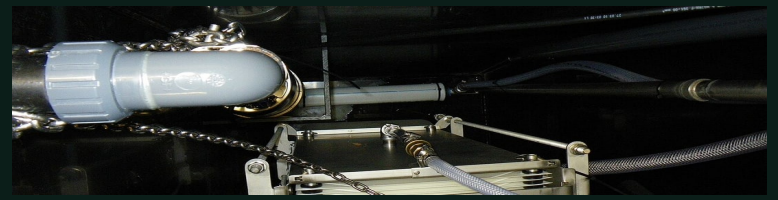
Gamma and EtO compatible as a terminal step, with the Janus wettability gradient intact afterwards.



Casting lines that already exist



UV cure, used asymmetrically

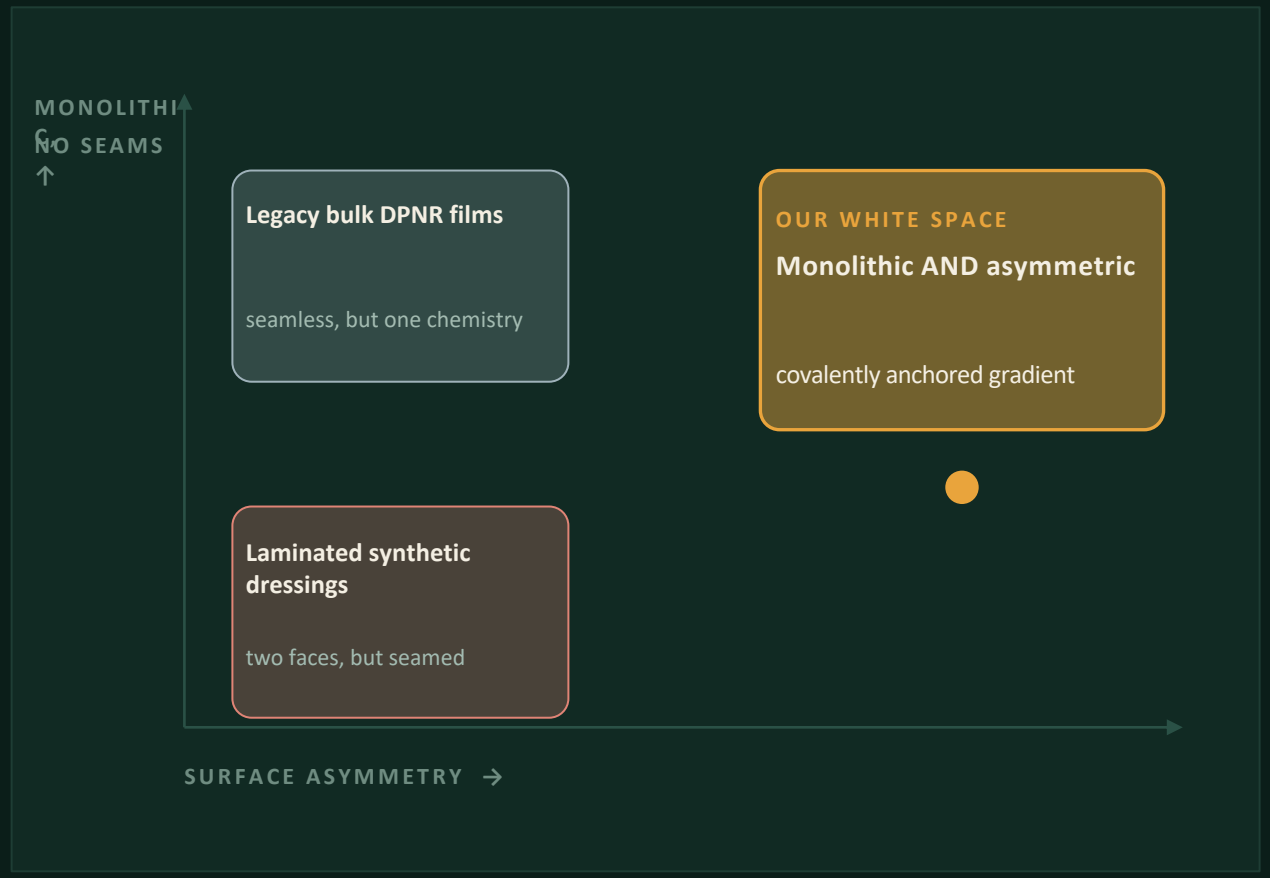


Roll-to-roll pilot scale-up

IN PLAIN TERMS We are not asking a factory to retool. We are asking it to run the line it already has, slightly differently.

Protection against structural and process copies

Our claims sit in the open ground between legacy bulk DPNR patents and laminated synthetic dressings.



INDEPENDENT APPARATUS PROTECTION — CLAIM 1

Any monolithic, non-laminated DPNR membrane with a continuous through-thickness gradient

- ≥ 35° water-contact-angle differential between faces
- ≥ 200% delamination-free cyclic strain
- no adhesive tie-layer anywhere in the construction

FOUR MANUFACTURING EMBODIMENTS — CLAIMS 2–13

A picket fence around the ways to make it

- unilateral hydrophilic grafting
- asymmetric crosslink-density curing
- phase-inverted micro-porous skins
- anti-adhesion configurations

IN PLAIN TERMS Nobody has claimed a single-piece rubber membrane with two deliberately different faces. That gap is what we are filing into.

Engineered to defeat design-arounds and obviousness challenges

Four pillars, each one a reason a cheaper copy does not perform.

01

Zero-seam architecture

A competitor cannot reach our performance with a cheap bilayer lamination without suffering wet shear failure. The seam is the weakness, and we do not have one.

02

Covalently anchored gradient

Unlike dip-coatings that wash off in wound fluid, our gradient is chemically locked into the polyisoprene backbone. It survives the wound, the wash and the sterilizer.

03

Biomimetic soft-tissue compliance

Matches dynamic tissue micromotion at 0.5–3.0 MPa with > 90% elastic recovery, where stiff synthetic polymers debond and abrade.

04

Divisional pipeline optionality

Separate claim families protect external wound dressings and high-value implantable barriers independently, so one prosecution outcome cannot sink both.

IN PLAIN TERMS Each pillar answers the same investor question: if this works, what stops a bigger company from copying it next year?

De-risking roadmap and value inflection milestones

Eighteen months from benchtop proof to a cleared wound-care product and an implantable programme in animals.

MONTHS 1–4

PHASE 1

Benchtop validation and provisional filing

- Finalize the unilateral grafting and curing protocol
- Confirm ΔWCA ≥ 35° across the two faces
- Cross-sectional SEM of the gradient
- ASTM D5712 extractable protein assays
- Lock in the priority filing date

Value inflection: a filed priority date and a membrane that measurably works.

MONTHS 5–10

PHASE 2

Preclinical biocompatibility and PCT filing

- ISO 10993 cytotoxicity and sensitization testing
- Ex vivo wet cyclic peel and delamination benchmarks
- Head-to-head against laminated predicates
- File international PCT claims

Value inflection: biocompatibility data plus international coverage.

MONTHS 11–18

PHASE 3

Pilot scale-up and 510(k) / partnering

- Transfer to a continuous roll-to-roll or dipping pilot line
- FDA 510(k) submission for the wound dressing
- Advance implantable anti-adhesion animal studies
- Open strategic partnering conversations

Value inflection: a clearance pathway underway and a partner at the table.

IN PLAIN TERMS Each phase ends with something an investor can check: a filing, a test report, or a regulatory submission.

A defensible platform, not a single product

Three reasons this is a platform company rather than a product.

01

BREAKTHROUGH MATERIAL SCIENCE

Turns a low-cost, renewable biopolymer into a high-margin, dual-function medical device platform — value created by structure, not by expensive inputs.

02

FORTRESS IP STRATEGY

Monolithic apparatus claims plus multi-embodiment process claims create durable exclusivity across both wound care and surgical implants.

03

CLEAR CAPITAL EFFICIENCY

Rapid 510(k) wound-care entry de-risks manufacturing and generates revenue ahead of the high-value implantable expansion.

Let's discuss the Phase 1 budget and IP timeline.

Phase 1 closes in four months with a filed priority date and measured ΔWCA. We are raising against that milestone.

NEXT STEP

Technical deep-dive
and data room access

Performance figures in this deck are platform design targets and draft-specification values. They are not yet independently verified; Phase 1 exists to verify them.

Appendix — the science

How the asymmetry is created, and what the membrane is made of.

How the asymmetry is made, in five stages

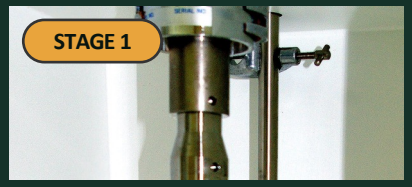
Allergen depletion with controlled native-protein retention → field-driven face segregation → fast network lock.



Allergen depletion

- Alkaline buffer and diafiltration
- Soluble allergens stripped
- Useful bound chemistry kept

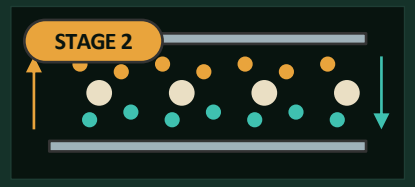
$C / C_0 = exp(-S \cdot N)$



Swelling and sizing

- Cosolvent swells the core
- Chilled, pulsed sonication
- Preserves M_w, prevents gel

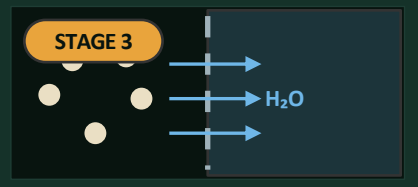
$D = k_BT / 3\pi\eta d$



Field alignment

- Moving conductive liners
- AC or asymmetric bias field
- Low ionic σ keeps Joule heat low

$v = \mu_e \cdot E \quad q = \sigma E^2$



Concentrate gently

- Cosolvent sweep, pervaporation
- Solvent-tolerant osmosis
- Concentrates, no boiling

$J_w = A \cdot (\Delta\pi - \Delta P)$

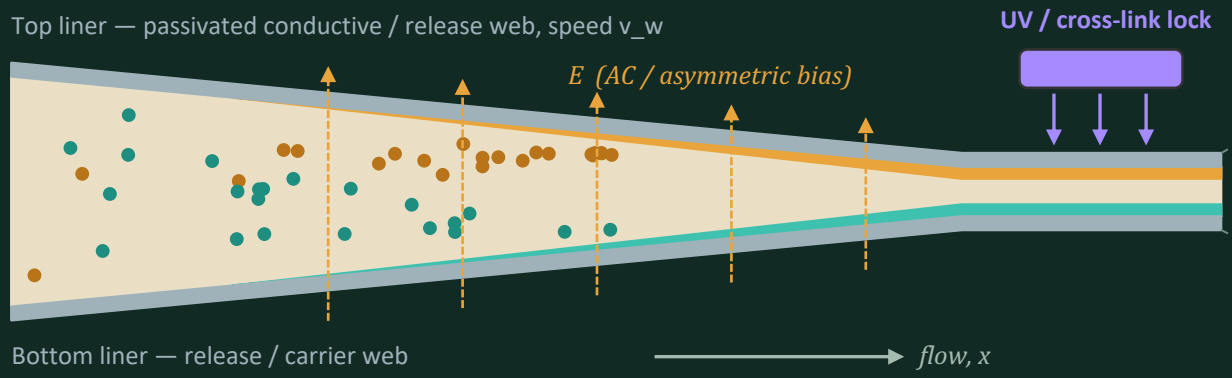


Draw and fast lock

- Heated web, controlled draw
- Rapid UV or e-beam fixation
- Gradient locked, covalently

$h_f = h_0 / DR$

TAPERED ALIGNMENT / THINNING CHANNEL (STAGES 2–4)



FINISHED MEMBRANE, IN SECTION



Peptide-enriched face
polar, bondable, takes ligands

cis-1,4-polyisoprene core
the elastic body that stretches

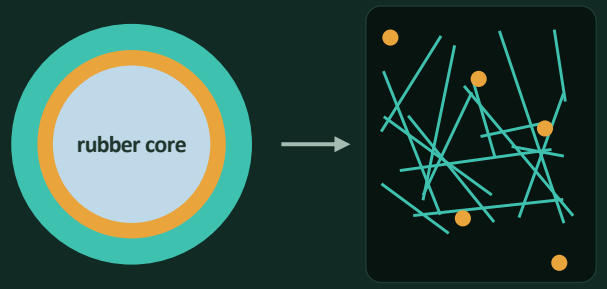
Phospholipid face
lipidic, low-fouling tissue side

one sheet, < 1 µm

Why the two faces separate by themselves

Each rubber chain has a lipid end and a peptide end. Slow, directional drying lets each find its preferred interface.

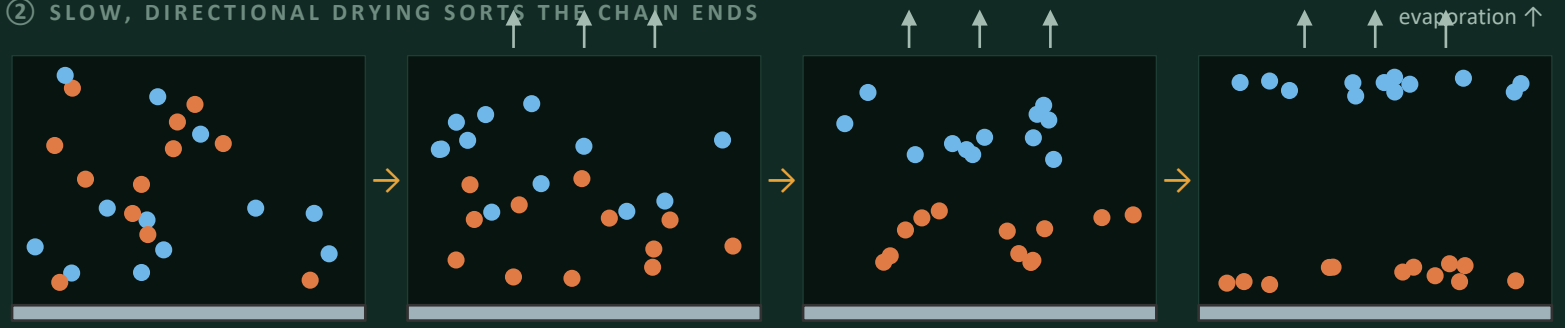
① THE BUILDING BLOCK



lipid + protein shell

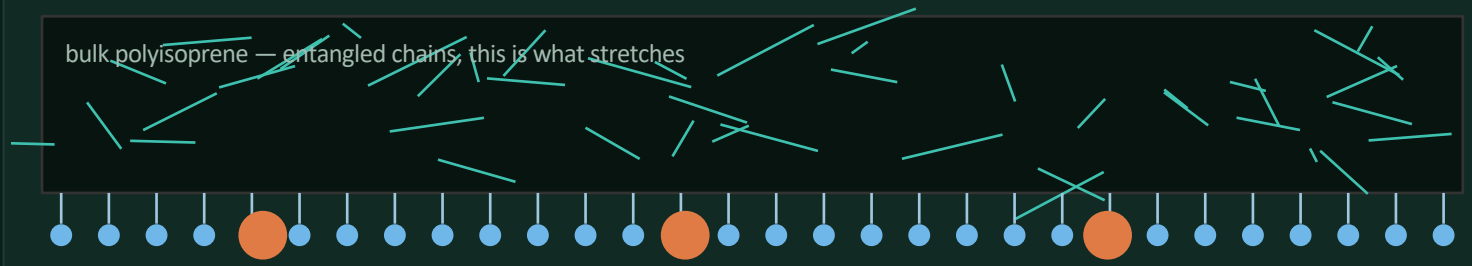
particles merge into one entangled network

② SLOW, DIRECTIONAL DRYING SORTS THE CHAIN ENDS



Lipid ends follow the drying front to the air side; peptide ends concentrate at the substrate side. The cure then fixes them there permanently.

③ THE RESULT — A STRUCTURED INTERFACE, NOT A COATING



ordered lipid layer with anchored proteins — this is the face the body touches

It is grown, not glued

The two faces come from the material's own chemistry during drying, so there is no interface to peel.

It cannot wash off

The gradient is part of the polymer backbone once cured, unlike a dip-coating that leaves in wound fluid.

IN PLAIN TERMS Think of a bowl of noodles where every strand has a greasy end and a sticky end. Dry it slowly from the top and the greasy ends all come to the surface by themselves.

What the membrane is made of

Natural rubber chains carry different chemistry at each end. We sort those ends, then lock them in place.

L_1 Phospholipid face
the gentle tissue side

L_2 Elastomeric core
stretch, recovery, gas transfer

L_3 Peptide face
polar and chemically bondable

One continuous phase — no tie-layer anywhere.

THE TISSUE SIDE

Lubricious and low-fouling; it does not grip granulating tissue, so removal is atraumatic.

WCA 95–120° native

THE BODY

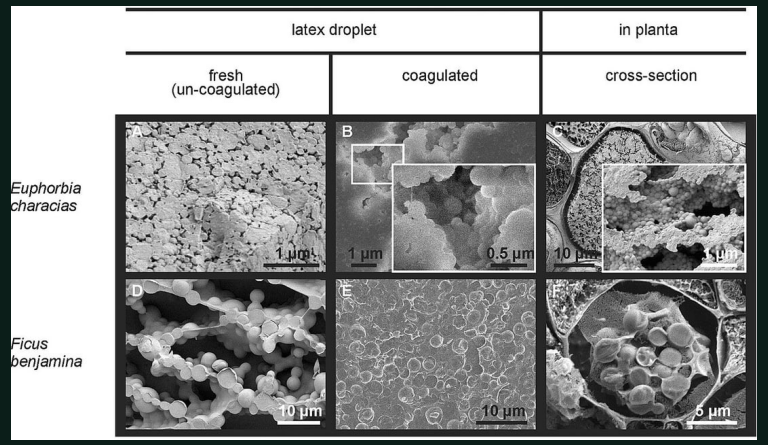
Bulk compliance, tear resistance, high gas permeability, room for a drug payload.

E 10 kPa – 5 MPa · >400% elongation

THE WORKING SIDE

Chemically addressable: amine, carboxyl and thiol handles for grafting and bonding.

WCA 25–65°, or 10–30° grafted



Cryo-SEM of plant latex: fresh droplets, coagulated material, particles in planta. Directional coalescence is what our process steers.

Georg Bauer et al., CC BY-SA 4.0, Wikimedia Commons

THE PLATFORM SPANS MEDICAL AND INDUSTRIAL GRADES

Axis	Medical grade	Industrial grade
Protein and allergen	DPNR, < 20 µg/dm² extractable	Partially deproteinized through to unwashed whole latex
Cure chemistry	E-beam, gamma, UV, peroxide-only — accelerator-free	Conventional sulfur with ZnO and accelerators
Where it sells	Wound care, surgical barriers, bioelectronics	Separation films, encapsulation, agricultural wraps