Choosing Materials for Microfluidic Chips

A practical guide to prototypes and production-ready microfluidic devices

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What we'll cover

1. Why material choice matters
2. Key questions to answer early
3. Material options: Glass, PDMS, Thermoplastics
4. Prototype-to-production transition risks
5. How OSMS supports selection and scale-up

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Why material choice matters

- Sets chemical compatibility and adsorption risk
- Defines optical performance for imaging and detection
- Constrains bonding, interfaces, and packaging
- Drives manufacturability, yield, lead-time, and unit cost

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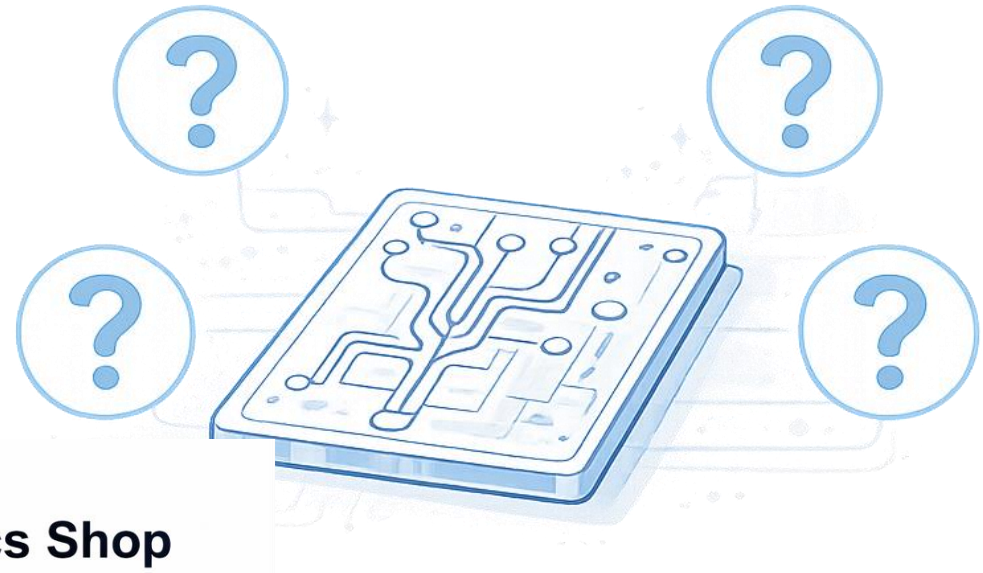
The questions that matter

- What fluids and reagents contact the chip?
- What needs to be seen (brightfield / fluorescence)?
- What pressures and temperatures will the device see?
- Single-use vs reusable (sterilisation, cleaning, wear)?
- How many units now—and later?
- What are the product constraints (cost, supply, regulatory)?



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Most common materials

Glass

Good for

Harsh chemistry
High pressure
Premium optics

Watch-outs

Higher cost
Longer lead times
Brittle handling

PDMS

Good for

Fast iteration
R&D workflows
Gas exchange

Watch-outs

Swelling/absorption
Solvent limits
Hard to scale

Thermoplastics

Good for

Prototyping
Disposable cartridges
Repeatable parts
Scale manufacturing

Watch-outs

Bonding choices
Tooling strategy
Chemistry varies

Tip: make a production plan early!

Glass: performance is the priority

- Excellent chemical resistance (including many organics)
- Strong optical access and low autofluorescence
- Stiff substrate for stable channels and higher pressure
- Plan for fabrication/bonding complexity and handling

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PDMS: fast iteration

- Great for rapid prototyping and geometry changes
- Optically clear; useful for early chips assays
- Gas permeability can be an advantage for cells
- Limitations: swelling and absorption with some organics
- Scaling to high volumes is often impractical

Thermoplastics: a practical path to production

- Best fit for low volume disposable chips/cartridges and scaled manufacture
- High repeatability; lower unit cost at volume
- Material options (COC/COP, PMMA, PC, PS) cover many needs
- Key decisions: tooling strategy when scaling-up beyond 500+
- Validate early to avoid surprises after tooling spend

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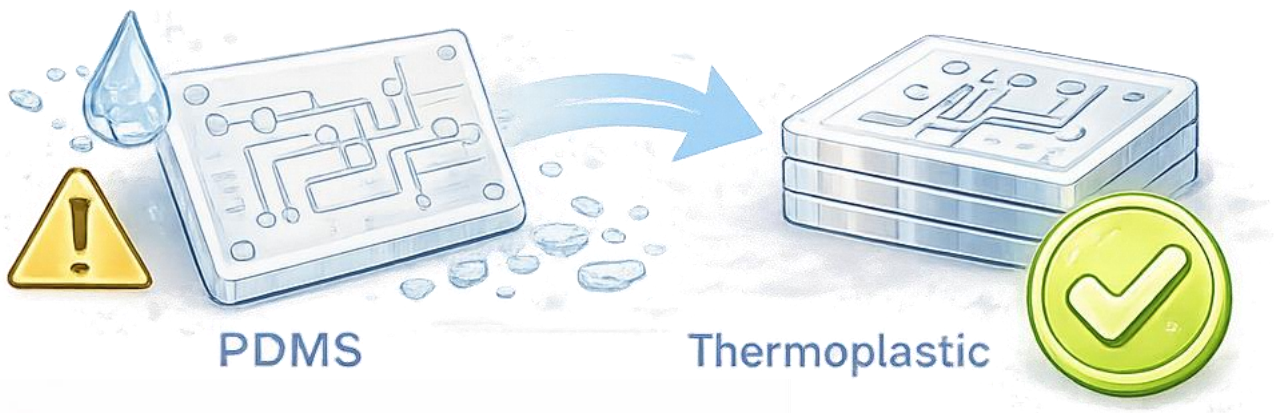
Prototype → production: material change problems

- Surface energy and wettability changes (flow stability, droplets)
- Assays are not optimised for scale-up material
- Changes in optical clarity, even if better, may make previous on-chip assay data useless (cal. curves)

Solution: Use the same material from prototype to production. This is where thermoplastics win.



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How OSMS supports material selection

Selection & design

- Requirements capture and shortlisting
- Design-for-manufacture (DFM) from day one
- Prototype plans aligned to the end goal (scale-up)

Validation & scale-up

- Reliability testing
- Risk reduction before tooling investment
- Scale plan (yield, tolerances, QA approach)

Next step: share your fluids, detection method, and target volumes — we'll recommend a material shortlist.

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