

Inkjet Photopolymers for Microfluidic Chip Development

Printer-, geometry-, fluid- and assay-specific validation of jetting, channels and thermal/chemical performance

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Highlights

- Process ranges are literature- or equipment-dependent and not universal boundaries.
- Jettability requires printer model, printhead, waveform, temperature, rheology and stability data.
- Channel performance is validated on the printed geometry with the intended fluid and assay.
- Medical-device and IVD routes are distinguished under Regulations (EU) 2017/745 and 2017/746.
- ISO 10993-1:2025 is a finished-device biological-evaluation framework, not resin certification.

Abstract

Inkjet microfluidic development couples jetting, cure, channel geometry, surface condition and fluid/assay compatibility.

Feature size, cycle time, viscosity and printability numbers depend on equipment and method. They are reported only with direct sources and explicit assumptions.

Elevated-temperature, PCR or solvent workflows require printed-chip chemical compatibility, thermal cycling, dimensional change, extractables/leachables and assay-interference testing.

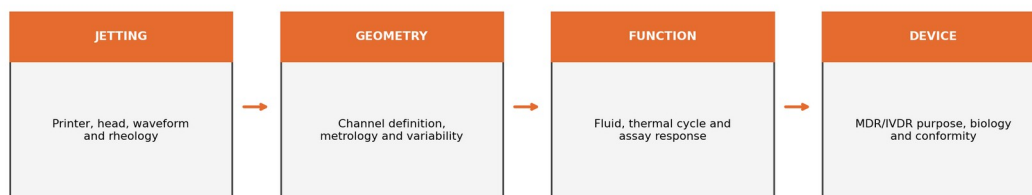
Keywords inkjet · microfluidic chip · jettability · channel · PCR · IVD research

Source use. Product evidence is in [1]; inkjet/microfluidic context in [2–3]; biological and MDR/IVDR scope in [4–6].

1. Jetting and feature evidence

The record identifies printer, printhead, waveform, jetting temperature, viscosity/surface tension method, drop behaviour, cure and measured feature definition.

- Label literature ranges separately.
- State geometry and metrology.
- Avoid universal cycle times.



Release requires traceable evidence at every gate; a catalogue label cannot bypass the chain.

Figure 1. WP-42 evidence gates from controlled material description to final acceptance.

2. Fluidic/thermal performance

Flow resistance depends strongly on channel dimension and direction of change. Chemical and PCR claims require exact fluid, temperature history and dimensional/functional acceptance.

- State hydraulic model assumptions.
- Test thermal cycling.
- Measure adsorption and assay interference.

3. Medical/IVD boundary

The applicable device framework depends on intended purpose. Supplier material data support but do not complete the finished medical or IVD evaluation.

4. Minimum controlled evidence before release

Control field	Required record	Release interpretation
Jetting	Printer, head, waveform and rheology	Catalogue description only until evidence is linked
Geometry	Channel definition, metrology and variability	Control process variables and change triggers
Function	Fluid, thermal cycle and assay response	Report method, result, uncertainty and limits
Device	MDR/IVDR purpose, biology and conformity	Apply final acceptance and responsibility boundary

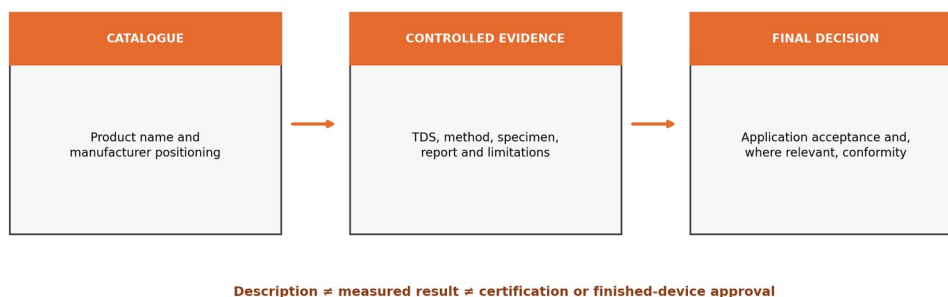


Figure 2. WP-42 separates catalogue positioning, measured evidence and final application decisions.

KEY INSIGHT

Precise product or application language is retained only when the exact formulation, method, processed specimen and controlled evidence can be traced.

5. Limitations

- No universal resolution or Z window is retained.
- A printed chip must be tested with the intended fluid.
- PCR suitability is not inferred from material labels.
- ISO 10993 is not certification.
- MDR and IVDR applicability is purpose-specific.

6. Conclusions

- Process ranges are literature- or equipment-dependent and not universal boundaries.
- Jettability requires printer model, printhead, waveform, temperature, rheology and stability data.
- ISO 10993-1:2025 is a finished-device biological-evaluation framework, not resin certification.
- This corrected candidate remains local and on HOLD until series-wide scientific, metadata and visual release checks are complete.

Revision note

Version 5.4 qualifies process ranges and chip claims, adds exact jettability/geometry/assay evidence and distinguishes MDR from IVDR finished-device responsibilities.

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Disclosure. Dr. Juan Segurola is founder and Scientific Director of 3Dresyns by Resyner Technologies S.L., the supplier of the materials discussed.

References

- [1] 3Dresyns. Current microfluidic inkjet TDS/IFU and controlled printer/chip reports.
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- [3] Macdonald, N. P. et al. (2017). Comparing microfluidic performance of 3D printing platforms. <https://doi.org/10.1021/acs.analchem.7b00136>
- [4] ISO 10993-1:2025. Biological evaluation of medical devices—Part 1.
- [5] Regulation (EU) 2017/745 on medical devices.
- [6] Regulation (EU) 2017/746 on in vitro diagnostic medical devices.