

Photopolymer Formulation Development for Volumetric Additive Manufacturing

Platform-, vial-, reconstruction- and dose-specific validation without family-wide biological claims

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Highlights

- VAM performance depends on vial geometry, projection/reconstruction strategy and dose distribution.
- Platform compatibility is verified individually, not inferred across desktop and enterprise systems.
- Fine Tuner dosage is a formulation-specific starting range, not a general VAM rule.
- HDT and other values require method, processed specimen and report traceability.
- Research scaffold and biological claims remain product- and application-specific.

Abstract

Volumetric additive manufacturing cures three-dimensional geometry through a distributed optical dose rather than a conventional layer sequence.

Material compatibility requires exact platform, vial, optics, projection/reconstruction, dose, absorption/scattering and post-cure conditions. Portfolio-wide compatibility and dosage rules are not retained.

Chemistry or a product-family name does not establish biological safety. Research-grade scaffold candidates and finished devices require their own evidence.

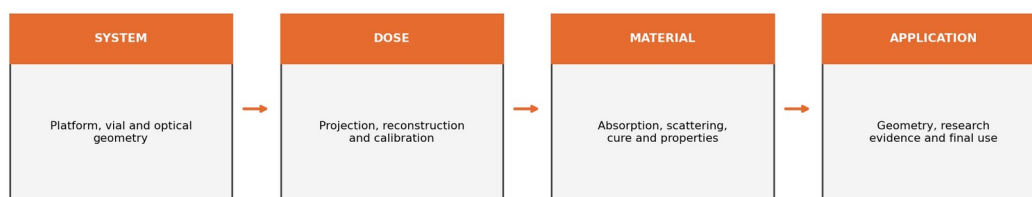
Keywords VAM · volumetric additive manufacturing · dose reconstruction · vial geometry · photopolymer

Source use. Product evidence is in [1]; VAM science in [2–3]; thermal/biological methods and formulation control in [4–6].

1. VAM system definition

The validation record identifies platform, vial material/geometry, refractive matching, projection angles, reconstruction algorithm, dose calibration and oxygen/thermal conditions.

- Measure dose distribution.
- Control optical absorption and scattering.
- Define reconstruction and acceptance metrics.



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

Figure 1. WP-34 evidence gates from controlled material description to final acceptance.

2. Formulation and property control

Fine Tuner and Light Blocker effects are calibrated in the exact resin/system. HDT or other numerical values require controlled methods and report identifiers.

- Do not generalize dose ranges.
- Verify stability and cure uniformity.
- Test the processed part.

3. Biological boundary

Family-wide biological labels are removed. Water-swelling scaffolds are research candidates requiring exact formulation and biological-model validation.

4. Minimum controlled evidence before release

Control field	Required record	Release interpretation
System	Platform, vial and optical geometry	Catalogue description only until evidence is linked
Dose	Projection, reconstruction and calibration	Control process variables and change triggers
Material	Absorption, scattering, cure and properties	Report method, result, uncertainty and limits
Application	Geometry, research evidence and final use	Apply final acceptance and responsibility boundary



Description ≠ measured result ≠ certification or finished-device approval

Figure 2. WP-34 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 platform-wide VAM compatibility is claimed.
- No universal additive loading is retained.
- HDT requires exact test conditions.
- Chemistry does not embed biocompatibility.
- Research scaffolds are not finished devices.

6. Conclusions

- VAM performance depends on vial geometry, projection/reconstruction strategy and dose distribution.
- Platform compatibility is verified individually, not inferred across desktop and enterprise systems.
- Research scaffold and biological claims remain product- and application-specific.
- This corrected candidate remains local and on HOLD until series-wide scientific, metadata and visual release checks are complete.

Revision note

Version 5.2 removes built-in biocompatibility and platform-wide VAM claims and adds exact platform, vial, reconstruction, dose and product-evidence controls.

Acknowledgements. The author acknowledges the 3Dresyns technical team and users whose manufacturing experience informed this correction.

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

References

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- [6] 3Dresyns WP-05. Fine Tuners and Light Blockers for VPP Process Calibration, corrected candidate.