

# Photocuring Pathway Taxonomy for Vat Photopolymerisation: Active Species, Network-Formation Modes, Spatial Gating and Qualification Boundaries

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## Statement of Significance

Photocuring labels frequently mix different scientific layers. A formulation may be described by its initiating species, bond-forming reaction, exposure sequence, spatial-gating method, evolving morphology or final network topology, even though these are not equivalent classification levels. This source-gate paper defines a layered taxonomy that prevents evidence from one level being transferred automatically to another. It also assigns every included pathway to a specialist Engineering Review and records the mechanisms that remain excluded until a controlled source set is recovered.

Keywords: vat photopolymerisation; photocuring taxonomy; active species; radical polymerisation; cationic polymerisation; photobase; dual cure; xolography; PIPS; vitrimer; RAFT; qualification

## Abstract

Vat photopolymerisation is often organised using single labels such as radical, cationic, dual cure, vitrimer, phase-separating or volumetric. These labels describe different parts of the material-process chain and are therefore not mutually exclusive. Radical and cationic identify active-species families; thiol-ene, ring opening and Michael addition identify network-forming transformations; dual cure and dual wavelength identify sequence or stimulus architecture; xolography and two-photon absorption identify spatial-selection routes; polymerisation-induced phase separation, vitrimer exchange and programmed cleavage describe structure evolution after or during network formation. Treating these categories as one flat list encourages unsupported transfer of kinetics, inhibition, post-exposure behaviour and qualification criteria. This research architecture proposes six independent axes: trigger and activation event, active species, network-forming transformation, temporal or spatial control architecture, structure-evolution overlay and required qualification endpoint. The matrix is built only from controlled 3Dresyns Engineering Review sources already developed for dual-colour gating, sequential dual cure, polymerisation-induced phase separation, gelation and vitrification, reactivatable networks, covalent adaptable networks, thiol-ene and thiol-yne chemistry, cationic ring-opening photopolymerisation, cleavable networks, cationic latency and photobase systems. It is a scope and source gate rather than a complete literature review. Latent platinum or non-ROMP ruthenium catalysis, photochemical [2+2] or [4+4] cycloaddition, and photoinitiator-free charge-transfer-complex VPP are not admitted into the evidence-backed matrix because the controlled project corpus supplied for this stage does not support them. The recommended next version is a narrow matrix paper that preserves specialist-paper boundaries; expansion should occur only after exact source recovery and independent verification.

## 1. Purpose and evidence boundary

ER-83 is the matrix paper reserved for classification across photocuring routes. Its role was created when the cationic stability review moved photobase and anionic chemistry to ER-82 and retained the broad mechanism taxonomy for a separate paper [E11,E12]. The purpose is not to restate every specialist review. It is to define

the level at which each label operates and to prevent a claim supported at one level from being transferred to another.

The present version uses only the controlled source corpus listed in the references. A pathway is included in the evidence-backed matrix when at least one supplied specialist paper defines its mechanism and qualification boundary. A pathway is recorded as context-only when a reviewed specialist paper exists but the exact manuscript is not packaged in this working set. A pathway remains excluded when no controlled project source supports its inclusion.

This version is a research architecture and source-and-scope gate. It does not constitute a systematic review, a quantitative meta-analysis, product positioning or a universal mechanism standard.

2. Why one-dimensional mechanism labels fail

A single photopolymer formulation can occupy several classifications simultaneously. A hybrid acrylate-epoxy resin can use radical and cationic active species, be processed through dual-wavelength control, undergo sequential network development and later display phase-separated morphology [8,E2,E8]. None of those labels can replace the others.

The most common category errors are systematic. Dual cure describes programmed reaction stages, not a unique active species. Polymerisation-induced phase separation describes reaction-driven morphology evolution, not an initiating mechanism. A vitrimer describes a topology capable of associative exchange, not the chemistry used to create the initial network. Xolography describes chemical spatial gating through two optical inputs, while the productive polymerisation step can still be radical [9,E1]. Two-photon absorption and upconversion describe photon-to-active-species pathways, not a universal bond-forming reaction [E10].

ER-83 therefore classifies the complete route as a tuple rather than assigning one master label. The minimum tuple is: trigger, active species, bond-forming event, control architecture, structure-evolution overlay and qualification endpoint.

3. Six-axis classification framework

The six axes below are deliberately independent. A complete description may require one entry on every axis. Leaving an axis unspecified should be treated as missing information rather than as evidence that the default radical-acrylate route applies.

Table 1. Six-axis classification framework.

| Axis   | Classification level           | What must be stated                                                                                                                | Minimum evidence                                                                   |
|--------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Axis 1 | Trigger and activation event   | Direct photolysis, sensitisation, photoswitching, energy transfer, photobase release, secondary heat or another declared stimulus. | Spectrum, irradiance, absorbed dose, activation kinetics and off-target response.  |
| Axis 2 | Active species                 | Radical, acid/cation, base, nucleophile, anion, dormant radical handle or metathesis-active catalyst.                              | Species-specific proxy, initiation efficiency, lifetime, scavenging and transport. |
| Axis 3 | Network-forming transformation | C=C chain growth, addition-transfer, ring opening, Michael addition, metathesis, associative exchange or programmed scission.      | Functional-group conversion, stoichiometry, connectivity and reaction products.    |

| Axis   | Classification level        | What must be stated                                                                                                        | Minimum evidence                                                                          |
|--------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Axis 4 | Temporal or spatial control | Single stage, sequential dual cure, dual wavelength, nonlinear excitation, dormant reactivation or post-exposure reaction. | Sequence, delay, cross-activation, dark reaction and spatial selectivity.                 |
| Axis 5 | Structure-evolution overlay | Gelation, vitrification, PIPS/PIMS, dynamic topology exchange, cleavage, depolymerisation or recovery.                     | State transition, morphology, gel fraction, mass balance and recovered-material identity. |
| Axis 6 | Qualification endpoint      | Green state, final network, morphology, post-print growth, dimensional response, service state or recovered feedstock.     | Declared comparator, conditioning, method, uncertainty and acceptance boundary.           |

## 4. Evidence-backed active-species and network-forming pathways

Table 2 contains the pathway families supported directly by the controlled corpus. The table does not rank performance and does not imply that every route is suitable for every printer. Numerical operating windows remain formulation-, source-, wavelength-, geometry- and process-specific.

Radical thiol-ene and thiol-yne pathways illustrate why the active-species label is insufficient. Both use radical intermediates, but the addition-transfer cycle, functional-group balance, gelation behaviour and oxygen response differ from conventional multifunctional-acrylate chain growth [1,2,E7]. Cationic routes likewise require separation of photoacid generation, monomer propagation, dark reaction and environmental sensitivity [3,4,E8,E11]. Photobase systems add a further distinction between release of a base or nucleophile and the subsequent base-catalysed or anionic transformation [5,E12].

Reversible-deactivation radical polymerisation introduces dormant handles that can support renewed chain growth. This is different from ordinary residual cure, sequential dual cure and vitrimer exchange. The controlled ER-62 source requires a defined dormant chemical handle and a matched negative control before post-print growth is described as reactivation [18-20,E5].

| Pathway class            | Active species                     | Network-forming event                                                          | Key qualification                                                     | Source               |
|--------------------------|------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------|
| Radical C=C chain growth | Carbon-centred radicals            | Chain growth and crosslinking of unsaturated groups                            | Conversion, oxygen response, gelation and retained cure               | ER-61; ER-80 context |
| Thiol-ene                | Thiyl and carbon-centred radicals  | Alternating addition and hydrogen transfer; step-growth-like network formation | Thiol/ene balance, gel conversion, oxygen tolerance and dark reaction | ER-64 [1,2]          |
| Thiol-yne                | Thiyl and vinyl-sulfide radicals   | Two sequential thiol additions per alkyne under appropriate conditions         | Two-addition accounting, residual thiol/yne and network connectivity  | ER-64 [E7]           |
| Mixed thiol-acrylate     | Thiyl and acrylate radicals        | Transfer-mediated addition plus acrylate homopolymerisation                    | Separate functional-group conversion and mixed-mechanism attribution  | ER-64 [E7]           |
| Cationic ring opening    | Photoacid-derived cationic centres | Epoxide or oxetane ring opening                                                | Acid generation, monomer-specific conversion, humidity and dark cure  | ER-65 [3,E8]         |
| Cationic vinyl ether     | Cationic chain carrier             | Vinyl-ether chain growth                                                       | Do not transfer epoxy kinetics or network assumptions                 | ER-65 [E8]           |

| Pathway class                            | Active species                                     | Network-forming event                                                            | Key qualification                                                                     | Source                  |
|------------------------------------------|----------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------|
| Radical-induced cationic initiation      | Radical upstream; acid/cation downstream           | Radical-promoted onium decomposition followed by cationic propagation            | Separate radical generation, acid generation and cationic conversion                  | ER-65; ER-81 [4,E8,E11] |
| Photobase-catalysed step growth          | Released base or nucleophile                       | Thiol-Michael, oxa-Michael, thiol-epoxy or related base-catalysed transformation | Base release, side-reaction fraction, dark conversion and retained rate               | ER-82 [5,E12]           |
| True anionic chain growth boundary       | Persistent anionic chain carrier                   | Anionic propagation only when demonstrated directly                              | Do not infer from base-catalysed Michael addition                                     | ER-82 [E12]             |
| Reactivatable RDRP                       | Reversibly dormant radical sites                   | Renewed chain growth, grafting, welding or monomer insertion                     | Dormant-handle identity, matched negative control and modification depth              | ER-62 v1.2 [18-20,E5]   |
| Photochemical ROMP                       | Metathesis-active catalyst                         | Ring-opening metathesis network formation                                        | Catalyst activation, monomer conversion, network integrity and cleavage route if used | ER-74 [14,E9]           |
| Radical ring-opening weak-link insertion | Carbon-centred radical with ring-opening comonomer | Backbone weak-link insertion during radical cure                                 | Comonomer incorporation, printability and source-bounded disassembly                  | ER-74 [15,E9]           |

Source-recovery note for Row 10. The exact ER-62 v1.2 controlling DOCX/PDF pair has been recovered and independently verified. Row 10 is therefore fully packaged within the bounded ER-62 scope; no broader RAFT claim is inferred.

## 5. Process, spatial-control and structure-evolution overlays

The rows in Table 3 are overlays rather than replacements for the active-species pathway. Sequential dual cure can be implemented with two radical initiating systems, radical followed by cationic chemistry, or another independently triggered pair [6-8,E2]. Dual-colour xolography adds a photoswitching and coincidence gate before the productive initiation step [9,E1]. Long-wavelength and superlinear routes alter how absorbed photons produce active species, while the downstream network-forming chemistry must still be stated [E10].

Structure-evolution overlays operate at another level. Gelation and vitrification describe connectivity and mobility transitions [16,17,E4]. PIPS and PIMS describe reaction-driven demixing and morphology arrest [10,11,E3]. Covalent adaptable networks retain connectivity while topology rearranges [12,13,E6]. Cleavable and depolymerisable networks require evidence of connectivity loss, identified recovered matter or a defined material loop rather than stress relaxation alone [14,15,E9].

| Overlay                                   | What it controls                                       | Material consequence                                      | Key qualification                                                   | Source                 |
|-------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------|------------------------|
| Sequential dual cure                      | Programmed stages in one formulation                   | Intermediate and final network states                     | Each stage, latency, dimensions and properties                      | ER-59 [6,7,E2]         |
| Dual-wavelength hybrid cure               | Spectrally differentiated pathways                     | Local or sequential radical/cationic network development  | Cross-activation and both functional-group conversions              | ER-59; ER-65 [8,E2,E8] |
| Dual-colour chemical gating               | Photoswitch intermediate plus second-colour initiation | Spatially conditional generation of productive initiation | Single-colour leakage, switching lifetime and two-colour window     | ER-58 [9,E1]           |
| Long-wavelength or superlinear initiation | Visible/red/NIR photon-to-active-species pathway       | Downstream chemistry must be declared separately          | Absorbed-photon response, order, threshold and final conversion     | ER-77 v1.1 [E10]       |
| Gelation and vitrification                | Network-state transition                               | Connectivity and later mobility restriction               | Gel criterion, vitrification criterion and conversion at each state | ER-61 [16,17,E4]       |

| Overlay                      | What it controls                                  | Material consequence                                  | Key qualification                                                | Source           |
|------------------------------|---------------------------------------------------|-------------------------------------------------------|------------------------------------------------------------------|------------------|
| PIPS/PIMS                    | Reaction-driven compatibility change              | Demixing, domain growth and morphology arrest         | Kinetics, morphology, optical feedback and final properties      | ER-60 [10,11,E3] |
| Covalent adaptable network   | Associative bond exchange after network formation | Topology rearrangement while connectivity is retained | Relaxation, creep, activation window and property retention      | ER-63 [12,13,E6] |
| Cleavage or depolymerisation | Triggered bond scission or connectivity loss      | Soluble products, recovered matter or feedstock route | Gel fraction, products, mass balance, fresh input and reprinting | ER-74 [14,15,E9] |

Source-recovery note for Row 16. The exact ER-77 v1.1 P2-corrected controlling DOCX/PDF pair has been recovered and independently verified. Row 16 is therefore fully packaged within the bounded ER-77 scope; two-photon printing remains outside this row and within the ER-29 boundary.

## 6. Orthogonality and combinability rules

The taxonomy is designed to permit combinations without collapsing them. A route should be written as a sequence of independently supported statements.

Example 1: a dual-wavelength acrylate-epoxy system is not classified only as dual cure. Its complete description includes radical acrylate formation, photoacid-driven cationic ring opening, wavelength-dependent cross-activation, intermediate network state and final hybrid morphology [8,E2,E8].

Example 2: a RAFT-containing PIMS formulation may use reversible-deactivation radical chemistry as the polymerisation control mechanism and PIMS as the morphology overlay. ER-62 governs retained reactivatability; ER-60 governs reaction-driven phase separation [E3,E5].

Example 3: a vitrimer printed by radical photopolymerisation has one route for initial network formation and another for later associative exchange. Exchange kinetics do not establish the original photopolymerisation mechanism, and radical conversion does not establish vitrimeric behaviour [12,13,E6].

Example 4: a chemically gated dual-colour system may use a photoswitch to control where and when a conventional initiating species is generated. The spatial gate and the network-forming chemistry must both be qualified [9,E1].

## 7. Minimum qualification architecture

No single response metric can validate every axis. Conversion alone does not identify active-species supply, gelation, morphology, dark reaction, reactivation or recovered-material identity. The minimum architecture in Table 4 links each classification statement to a measurement or control.

The framework follows the general evidence discipline of RP-02: identity, process state, measurement method, comparator, uncertainty and final delivered state must remain linked. ISO/ASTM 52900:2021 supplies general additive-manufacturing vocabulary, not a mechanism taxonomy or acceptance method [F1,S1].

| Domain                          | Minimum record or measurement                                                                    | Required conclusion                                              |
|---------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Controlled formulation identity | Version, batch, reactive groups, initiator or catalyst, additives and permitted disclosure level | The pathway assignment belongs to a reproducible material state. |

| Domain                          | Minimum record or measurement                                                                     | Required conclusion                                                                |
|---------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Optical or external trigger     | Spectrum, irradiance, absorbed-dose basis, time sequence, temperature and atmosphere              | The initiating event is defined rather than inferred from lamp name.               |
| Active-species evidence         | Direct measurement or validated proxy appropriate to radical, acid, base, anion or dormant handle | The productive species is distinguished from absorption alone.                     |
| Reaction-specific conversion    | Separate functional-group conversion where more than one chemistry is present                     | Hybrid and dual-cure routes are not reduced to total conversion.                   |
| Network state                   | Gelation, modulus development, extractables and vitrification where relevant                      | Chemical reaction is linked to connectivity and mobility.                          |
| Spatial or temporal selectivity | Single-input controls, delay dependence, dark hold and through-volume response                    | A gating or sequencing claim is demonstrated.                                      |
| Morphology or topology          | Domain size/connectivity, stress relaxation, exchange or cleavage measurements                    | Structure-evolution overlays are not inferred from composition.                    |
| Final delivered state           | Dimensions, mechanics, thermal response, conditioning and application-specific function           | Green-state success is not substituted for delivered performance.                  |
| Reactivation or recovery        | Matched negative control, dry mass, product identity, fresh-input fraction and cycle history      | Residual cure, swelling and recovered matter are separated from controlled re-use. |

## 8. Specialist-paper boundaries

ER-83 must remain shorter and less mechanistically detailed than the specialist papers. It may define the classification level, list the evidence needed to assign a route and direct the reader to the controlling review. It must not reproduce each specialist paper's numerical claims, product examples, full bibliography or proposed descriptors.

Table 5 records the controlling boundaries. The boundary is not merely editorial. It prevents a mechanism being qualified using measurements designed for another route.

| Source | Controlling scope                                                          | ER-83 boundary                                                                                 |
|--------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| ER-58  | Dual-colour photoswitching, molecular design and xolographic qualification | ER-83 may classify dual-colour gating but must not repeat patent mapping or DCPI design rules. |
| ER-59  | Sequential dual-cure architecture and intermediate/final network states    | ER-83 classifies sequence architecture only.                                                   |
| ER-60  | PIPS/PIMS kinetics, morphology arrest and functional microstructure        | ER-83 treats PIPS/PIMS as a structure-evolution overlay.                                       |
| ER-61  | Gelation, vitrification and mobility arrest                                | ER-83 uses these as cross-cutting state variables, not new descriptors.                        |
| ER-62  | RAFT, photoiniferter and nitroxide-mediated reactivation                   | ER-83 separates dormant reactivation from dual cure, residual cure and vitrimer exchange.      |
| ER-63  | Covalent adaptable networks and vitrimer topology                          | ER-83 classifies associative exchange without reproducing reprocessing metrics.                |
| ER-64  | Thiol-ene, thiol-yne and mixed thiol-acrylate network formation            | ER-83 preserves reaction-class distinctions and chemistry-specific stoichiometry.              |
| ER-65  | Cationic ring opening, PAG chemistry, dark cure and hybrid systems         | ER-83 separates acid generation, propagation and spatial control.                              |
| ER-74  | Cleavable and depolymerisable networks, ROMP and rROP weak-link routes     | ER-83 may classify bond-forming and scission pathways but not circularity claims.              |

| Source | Controlling scope                                                    | ER-83 boundary                                                                    |
|--------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| ER-77  | Long-wavelength and superlinear photoinitiation                      | ER-83 treats photon-to-active-species pathway as an independent axis.             |
| ER-81  | In-can cationic latency and premature polymerisation                 | ER-83 does not absorb storage-stability qualification.                            |
| ER-82  | Photobase release, base-catalysed pathways and true-anionic boundary | ER-83 may classify these pathways but not recreate the photobase evidence review. |

## 9. Source-gap register

Several mechanisms were considered during planning but are not admitted into the present evidence-backed matrix. Their exclusion is not a statement that the phenomena do not exist. It records that the supplied controlled corpus does not support a publication-grade claim at this stage.

A mechanism can enter a later version only after the exact primary source is recovered, bibliographic metadata are verified, the demonstrated printing architecture is identified, and the claim is bounded to the source conditions.

| Planned category                                        | Status                     | Reason                                                                                                                                                                                                             | Required next action                                                                                      |
|---------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Latent platinum hydrosilylation in direct VPP           | Excluded                   | No controlled primary-source set in the supplied project corpus.                                                                                                                                                   | Recover exact VPP demonstration and distinguish direct printing from cast silicone.                       |
| Latent ruthenium catalysis beyond source-supported ROMP | Excluded                   | Only the ROMP route is supported through ER-74 in this package.                                                                                                                                                    | Recover catalyst-specific primary studies before adding a broader metal-catalysis class.                  |
| Photochemical [2+2] or [4+4] cycloaddition              | Excluded                   | No controlled VPP source supplied.                                                                                                                                                                                 | Verify that network formation, not only molecular photochemistry, was demonstrated in VPP.                |
| Photoinitiator-free charge-transfer-complex VPP         | Excluded                   | No controlled VPP source supplied.                                                                                                                                                                                 | Recover exact donor/acceptor system, wavelength, conversion and printing evidence.                        |
| Full two-photon and upconversion taxonomy               | Context only               | ER-77 v1.1 is recovered and verifies the long-wavelength/upconversion boundary; the exact ER-29 controlling final package is not packaged here, so a full two-photon taxonomy remains outside the retained matrix. | Recover ER-29 only if a full two-photon expansion is proposed; no action is required for retained Row 16. |
| Broad RAFT pathway bibliography                         | Closed for retained Row 10 | The exact ER-62 v1.2 controlling DOCX/PDF pair is recovered and independently verified; retained Row 10 is fully packaged within the ER-62 boundary.                                                               | None for the current matrix; any broader RAFT expansion requires a separate source-expansion gate.        |

## 10. Decision gate for v0.3

The recommended route is a narrow matrix paper built from the evidence-backed classes in Tables 2 and 3. This creates an independent contribution because the classification tuple and cross-boundary rules are not supplied by any one specialist review.

Expansion to latent metal catalysis, photochemical cycloaddition or photoinitiator-free charge-transfer-complex VPP should remain on HOLD until a controlled source pack exists. The exact controlling ER-62 v1.2 and ER-77 v1.1 packages are now recovered and independently verified, so retained Rows 10 and 16 are fully packaged. A full two-photon taxonomy remains outside the retained matrix until the ER-29 controlling final package is recovered.

The v0.3 source gate is satisfied for every retained specialist paper represented in Tables 2 and 3. Any later expansion must preserve proposition-level mapping, explicit non-duplication against ER-58, ER-59, ER-60, ER-62, ER-63, ER-64, ER-65, ER-74, ER-77, ER-81 and ER-82, and exclusion of any row supported only by a planning note.

## 11. Conclusions

Photocuring pathway classification requires more than one mechanism label.

Trigger, active species, bond-forming event, process control, structure evolution and qualification endpoint are independent dimensions.

Dual cure, xolography, PIPS, vitrimer exchange and reactivatable networks are not synonyms for radical, cationic or anionic polymerisation.

A formulation may combine multiple dimensions, but every dimension requires its own evidence.

ER-83 should proceed as a narrow matrix and boundary paper. Rows 10 and 16 now have their exact controlling final packages recovered and verified; unsupported planned categories remain excluded or context-only as recorded in the source-gap register.

## Limitations

This document is a source and scope architecture, not a systematic review or quantitative meta-analysis. It does not claim exhaustiveness. It does not establish universal pathway boundaries outside the supplied corpus. Any context-only expansion item must be rechecked against its exact controlling final manuscript before release. No product-specific compatibility, performance, safety, regulatory or freedom-to-operate conclusion is made.

## Declarations

**Author contributions:** Juan Segurola: conceptualisation, industrial question definition, source-corpus selection, taxonomy design, writing and critical review.

**Competing interests:** The author is founder, CEO and CTO of 3Dresyns by Resyner Technologies S.L. No commercial product is classified or presented as independent mechanistic evidence in this source-gate paper.

**Data availability:** No new experimental dataset was generated.

author documented judgement.

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## Controlled Engineering Review corpus

- [E1] ER-58, Dual-Colour Photoinitiator Design Space for Xolography, version 1.2, controlled final-delta-reviewed document.
- [E2] ER-59, Sequential Dual-Cure Networks in Vat Photopolymerisation, version 1.2, controlled final-delta-reviewed document.
- [E3] ER-60, Polymerisation-Induced Phase Separation in Vat Photopolymerisation, version 1.2, controlled final-delta-reviewed document.
- [E4] ER-61, Gelation, Vitrification and Mobility Arrest in Vat Photopolymerisation, version 1.1.
- [E5] ER-62, Living and Reactivable Polymer Networks in Vat Photopolymerisation, version 1.2 final candidate; exact controlling DOCX/PDF pair recovered and independently verified for ER-83 source closure.
- [E6] ER-63, Covalent Adaptable Networks and Vitrimers Topology in Vat Photopolymerisation, version 1.1.
- [E7] ER-64, Thiol-Ene and Thiol-Yne Photopolymerisation in VPP, version 1.1.
- [E8] ER-65, Cationic Ring-Opening Photopolymerisation in VPP, version 1.1.
- [E9] ER-74, Cleavable and Depolymerisable Networks in VPP, version 1.1.
- [E10] ER-77, Long-Wavelength and Superlinear Photoinitiation in VPP, version 1.1 P2-corrected final candidate; exact controlling DOCX/PDF pair recovered and independently verified for ER-83 source closure.
- [E11] ER-81, In-Can Stability, Latency and Premature Cationic Polymerisation in Light-Curable Formulations, approved context version 0.3.
- [E12] ER-82, Photobase-Mediated and Anionic Photocuring in VPP, approved version 0.3 review record.
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