# Application Note: LASERSense™ in Wood Laser-Curable Adhesive Systems

## 1. Purpose & Scope

This application guide describes the use of LASERSense™ as a laser-responsive sensitizing additive in laser-curable adhesive systems.

LASERSense™ is intended for use by adhesive formulators and process engineers designing systems where localized laser irradiation is used to develop cure in thick, filled, or optically scattering bond lines.

This document addresses formulation-level behavior and process integration.
It does not describe finished adhesives and does not offer adhesive products for sale.

## 2. Abstract

LASERSense™ is a laser-responsive sensitizing additive designed to improve energy utilization within the adhesive layer, enabling higher production throughput and more reliable depth of cure under localized laser irradiation.

The technology is particularly relevant for adhesive systems applied in thick bond lines, porous substrates, or optically scattering assemblies, where UV or oven-based curing approaches limit line speed, energy efficiency, or cure uniformity.

This guide documents system-level design principles for integrating LASERSense™ into laser-curable adhesive formulations. Performance outcomes depend on formulation chemistry and process conditions.

## 3. System-Level Mechanism of LASERSense™

LASERSense™ is not a pigment, not a catalyst, and not an adhesive.
It functions as a laser-responsive sensitizing additive within an existing adhesive formulation.

Under laser irradiation (visible or near-infrared), LASERSense™ contributes through a combination of physical and auxiliary chemical effects:

### 3.1 Photothermal Energy Conversion

LASERSense™ absorbs incident laser energy and converts it into localized thermal energy within the adhesive layer. This localized heating supports activation of curing reactions across bond lines where optical penetration is limited by fillers, pigmentation, or substrate scattering.

### 3.2 Auxiliary Redox Participation

Copper centers within LASERSense™ can participate in reversible $Cu^{2+}/Cu^{+}$ redox processes that promote efficient energy utilization by the formulation's existing curing chemistry. These effects are auxiliary in nature and do not constitute standalone chemical catalysis.

### 3.3 In-Layer Cure Development

Through the combined photothermal and auxiliary redox effects, LASERSense™ supports cure development throughout the adhesive thickness rather than surface-limited activation.

All effects are system-dependent and complement, rather than replace, the adhesive's primary curing mechanism.

## 4. Suitable Adhesive Systems

LASERSense™ is compatible with adhesive systems that exhibit thermally assisted or hybrid curing behavior.

### Commonly suitable systems

- Polyurethane (1K and 2K)
- Modified PU and hybrid systems
- Epoxy systems with thermal or dual-cure capability
- Acrylic and methacrylate hybrids
- Wood and engineered-timber adhesives

### Use with caution

- Pure UV-only thin-film systems
- Formulations containing strong copper chelators
- Applications requiring optical transparency

## 5. Recommended Loading Levels

| Development stage | Typical LASERSense™ loading |
|---|---|
| Feasibility screening | 1–3 wt% |
| Industrial laser curing | 5–10 wt% |
| Thick / porous substrates | 8–12 wt% |

## 6. Dispersion & Formulation Guidelines

- Pre-disperse LASERSense™ into the resin or polyol phase
- Apply sufficient shear to achieve uniform dispersion
- Avoid agglomeration, which reduces laser response efficiency
- Verify viscosity, storage stability, and processing window at target loading

# 7. Laser Process Parameters (Typical Ranges)

| Parameter | Typical range |
|---|---|
| Wavelength | 808 nm / 980 nm / 1064 nm |
| Laser type | Diode or fiber |
| Power density | 5–30 $W \cdot cm^{-2}$ |
| Exposure time | 0.1–5 s |
| Irradiation mode | Line scan or spot |

Laser curing enabled by LASERSense™ is localized and rapid, eliminating the need for bulk oven heating in many production environments.

# 8. Applications

## Proven applications

- Engineered wood bonding
- Zero-joint edge banding
- Thick bond-line laminations

## Adjacent and emerging applications

- Structural assembly adhesives
- Laser-assisted repair bonding
- Hybrid curing production lines combining laser and ambient cure

# 9. Limitations & Design Considerations

- LASERSense™ does not replace resins, initiators, or crosslinkers
- Cure performance depends on formulation chemistry and laser conditions
- Optical penetration remains system-dependent
- Validation must be performed at formulation + process level

# 10. Regulatory & Standards Considerations

LASERSense™ is supplied as an industrial sensitizing additive and is not an adhesive.

Performance data associated with LASERSense™ may be generated using standardized test methods (for example, EN 204 procedures) for comparative and developmental evaluation.

Compliance with standards such as EN 204 D4 applies exclusively to the finished adhesive formulation, which remains the responsibility of the adhesive manufacturer. Use of LASERSense™ does not constitute certification, approval, or guarantee of compliance with any standard.

# 11. Safety & Handling

- Industrial inorganic copper-containing additive
- Follow SDS guidance for handling and disposal
- Confirm regulatory acceptance of copper-containing materials in the target market

# 12. Summary

LASERSense™ enables laser-curable adhesive systems to operate efficiently in applications where UV exposure or oven curing limit throughput, energy efficiency, or depth of cure.

By promoting efficient energy utilization under localized laser irradiation, LASERSense™ supports faster processing and more reliable cure development in thick, optically challenging bond lines. Successful implementation requires coordinated formulation design and process optimization.

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