IMSE Technology Validation – Inks, Components, Adhesives & Material Stacks

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IMSE Technology Validation

IMSE Technology Validation at Tactotek

- Functional full IMSE material stack
  - Individual certification processes
  - Different resins

- Validation tests
  - Thermal Shock 1000h (-40°C to 85°C)
  - Damp Heat 1000h (85°C/85%RH)
  - Aging 1000h (110°C)

- Continuous Datalogging
  - Resistance + Cross over resistance (dielectrics)
  - LED $V_f$
  - LED brightness and color change measured before and after validation (non-continuous)
T-Process

“T-Process” = Industrialization

T1 - Technical Concept
T2 - Manufacturability & Reliability
T3 - Production repeatability

IMSE Certified

Customer Projects
IMSE Material Stack

Hard coating

Visual surface (A film)

Graphic inks

IM Resin

Conductor1

Graphic inks

LED

SMT Materials

Cond2

Dielectric

Functional film (B film)

Injection molding

Thermoforming
Conductive Ink Validation

- Conductive ink’s compatibility to IMSE reference graphic inks and process

**T1 – Printability (2D)**
- Tens of pcs
- Rheological properties
- Drying/Curing conditions
- Sheet resistivity
- Cross-sectional area + thickness
- Adhesion
- Possibility to validate also dielectric

**T2 - Thermoformability (3D)**
- Tens of pcs
- T1 added with
  - Elongation

**T3 - Injection Molding (3D full stack)**
- Hundreds of pcs
- T1 + T2 added with
  - Variation between prints and batches
  - Ink washout in injection molding
  - Cost
  - Environmental testing

**IMSE Designer™ & IMSE Builder™**

PASS

FAIL

IMSE CERTIFIED
Conductive Ink Validation

- Continuous material development for IMSE together with material suppliers
- Over 50 different conductive inks tested
  - Elongation vs resistance
  - Setting the conductive ink limits to 3D shapes in designs
- Single vendor stacks
Conductive Ink Validation – T2

ELONGATION PROPERTIES
- Universal test layout

CONDUCTIVE INK PROPERTIES
- Cross-sectional area
- Layer thickness
- Actual line width

ELECTRICAL PROPERTIES
- Sheet resistivity

<table>
<thead>
<tr>
<th>Sheet resistivity, Average (mΩ/sq/10um)</th>
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<tbody>
<tr>
<td>Ink A</td>
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Baseline to process and quality control

IMSE Designer™ & IMSE Builder™
Component Validation

- Component terminal and package suitability to IMSE
- Conductive adhesives as interconnection materials

T1 - Technical concept
- Package specifications
  - Materials
  - Terminals
  - Moisture sensitive level
- Requirement for ideal component package

T2 - Manufacturability & Reliability
- 200pcs
- Thermal shock (OFF) 4 days + 85°C/85% (ON) 4 days
- Illumination & Physical assessment

T3 – Production repeatability & Certification
- 10000 pcs
- Thermal shock (OFF) 42 days
- 85°C/85% (ON) 42 days
- Illumination & Physical assessment

IMSE Designer™ & IMSE Builder™

FAIL -> T1
PASS -> T2
IMSE CERTIFIED
Surface Mounting Adhesives (SMT) Validation

- **T1** Pre-screening
  - Adhesive data
  - Verify key properties
  - **PASS**

- **T2** Manufacturability & Reliability
  - Test structures
  - Reliability testing 100h
  - **PASS**

- **T3** Production repeatability & certification
  - Component certification platform
  - Reliability testing 42d (1000h)
  - **IMSE CERTIFIED**

IMSE Designer™ & IMSE Builder™
Material Stack Platform

- **Functional full IMSE material stack**
  - Individual certification processes
  - Different resins

- **Validation tests**
  - Thermal Shock 1000h (-40°C to 85°C)
  - Damp Heat 1000h (85°C/85%RH)
  - Aging 1000h (110°C)

- **Continuous Datalogging**
  - Resistance + Insulation resistance
  - LED $V_f$
  - LED brightness and color change measured before and after validation (non-continuous)
IMSE Technology Validation

Use case specific validation

Automotive
Wearables
Building Automation
Appliances

Material Stack Platform
IMSE certified functional material stacks
- Functional Ink IMSE material stack
  - Individual certification processes
  - Different systems
- Validation tests
  - Thermal Shock (-40°C to 85°C)
  - Damp-Heat 1200h / 85°C/85%RH
  - Aging 2000h / 83°C
- Continuity and Tolerance
  - Resistance + ±20% over resistance (dielectric)
  - LED V:
  - LED brightness and color change measured before and after validation (continuous)

Conductive Ink Validation
Component Validation
Surface Mounting Adhesives Validation
This is not the future. This is today.

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