



Materials For Harsh Environments

Laser Markable Materials

Polyonics R&D Test Report: GM Automotive Under-the-Hood Label Test Results

Objective: Test the Polyonics family of laser markable label materials (LML) to the GM Performance Requirements for under-the-hood labels, GMW 14573 and GM 6121M.

Background: Polyonics has developed a family of black and white LML polyimide materials with low surface energy (LSE) pressure sensitive adhesives (PSA). These materials are used for identifying and tracking components in extreme environments such as automotive under-the-hood applications, where high temperatures, harsh chemicals and a high degree of abrasion are the norm. The LML materials can be ablated by low power CO₂, YAG and fiber lasers and offer a more durable alternative to traditional thermal transfer printed labels (TTP) as well as a high temperature alternative to PET and acrylic LML materials. The industry standard for under-the-hood labels is the GM 6121M requirements document that has recently been superseded by the GMW 14573.

Test Methods: The full series of required tests for under-the-hood labels was performed per the current GMW 14573 requirements document plus additional pertinent tests per the previous GM 6121M document. The LML materials tested included Polyonics XF-670 (black), XF-671 (white) and XF-672 (white). In addition, a polyester (PET) thermal transfer printed label material was also tested for comparison.

The following areas of testing were included:

- **Label Adhesion**
- **Coating Strength**
- **Abrasion**
- **Fluid Resistance**
- **Heat and Humidity**
- **Weatherability**

Results: All three LML materials successfully passed all GM and GMW tests with the only exception being the abrasion tests. In that area, XF-670 performed the best of the three passing the top level GM 6121M 500 cycle test. XF-672 provided the next best performance, falling short only on the 500 cycle test, but passing the GMW 3208 300 cycle test. XF-671 fell short on the 500 and 300 cycle tests, but passed the GMW 3208 100 cycle test. All three LML materials surpassed the performance of the TTP PET label material.

Conclusions: Polyonics LML materials provide viable alternatives for automotive under-the-hood label applications involving long term exposure to high temperatures, harsh chemicals and substantial abrasion.



Polyonics Laser Markable Label Material Test Report

GMW 14573/GM 6121M Automotive Label Requirements

| | Requirements | Test | Procedure | Conditions | Laser Markable Label Materials | | | Thermal Transfer Printed Label Material |
|------------------|---------------------------------|------|--------------------------|----------------------------------|--------------------------------|--------|--------|---|
| | | | | | XF-670 | XF-671 | XF-672 | Polyester |
| Label Adhesion | Grip Separation | 1a | ISO 8512-2 | As Delivered | + | + | + | + |
| | Grip Separation | 1a | ISO 8512-2 | After GMW 14729 | + | + | + | + |
| | Grip Separation | 1a | ISO 8512-2 | After Temp Cycle | + | + | + | + |
| Coating Strength | Cross Hatch | 1b | GMW 14829 | As Delivered | + | + | + | + |
| | Cross Hatch | 1b | GMW 14829 | After GMW 14729 | + | + | + | + |
| | Cross Hatch | 1b | GMW 14829 | After Temp Cycle | + | + | + | + |
| Abrasion | Abrasion | 2b | GMW 3208 | 100 Cycles | + | + | + | + |
| | Abrasion | 2c | GMW 3208 | 300 Cycles | + | - | + | - |
| | Abrasion | - | GM 6121M | 500 Cycles | + | - | - | - |
| Fluid Resistance | Detergent Resistance | 3a | GMW 14573 | 4 hrs 23°C | + | + | + | + |
| | Engine Oil Resistance | 3b | GMW 14573 | 4 hrs 150°C | + | + | + | + |
| | Windshield Washer Resistance | 3c | GMW 14573 | 4 hrs 23°C | + | + | + | + |
| | Brake Fluid Resistance | - | GM 6121M | 4 HRS Room Temp | + | + | + | - |
| | Fuel Resistance | 3e | GMW 14333-A | 15min/Room Temp 4 cycles | + | + | + | + |
| | Ethanol Rubbing | 3f-2 | GMW 15891 | | + | + | + | + |
| | Ethanol Dip | 3f-1 | GMW 14333-B | | + | + | + | + |
| | Transmission Fluid | 3q | GMW 16444 | 4 HRS 150°C | + | + | + | + |
| Heat/Humidity | Ultra Low Sulfur Diesel Fuel | 3h | 9986200 | 4 HRS 23°C | + | + | + | + |
| | Humidity Resistance | 4 | GMW 14729 ASTM 4587 | 144 HRS 40°C 100% RH | + | + | + | + |
| | Resistance to Temperature Cycle | 5c | GMW 14573 | 90°C/23°C/-30°C/23°C 2 Cycles | + | + | + | + |
| Weatherability | Heat Aging | 6c | GMW 14573 | 1600 hrs 150°C | + | + | + | + |
| | UV Resistance | - | QUV Weatherometer (UV-A) | 2500 hrs @70°C | + | + | + | + |

(+) Products fully pass all aspects of test requirements
 (-) Product falls short in at least one aspect of test requirements

For additional technical information, please contact: info@polyonics.com



World Headquarters
 28 Industrial Park Drive
 Westmoreland, NH 03467-4740 USA
 1.888.765.9669
www.polyonics.com

Polyonics - Asia
 Dongguan, China
 86.755.8825.2429
infoasia@polyonics.com

