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## HUNTSMAN ADVANCED MATERIALS

### Adhesive Technical Support Europe

#### Comparison of ARALDITE® AV 138 M-1 / HV 998-1 & ARALDITE® AV 138 M-2 (LME 11902) / HV 998-1

#### NEW PRODUCT DEVELOPMENT REPORT

**PREPARED BY**

Duncan HOWLAND  
HUNTSMAN ADVANCED MATERIALS  
Klybeckstrasse 200  
4057 BASEL  
Switzerland

#### INTRODUCTION

ARALDITE® AV 138 M-2 (LME 11902) / HV 998-1 is a new adhesive which has been developed to replace ARALDITE® AV 138 M-1 / HV 998-1. This is due to a change in hazard classification of a raw material used in the resin component (AV 138 M-1). The characteristics and properties of the ARALDITE® AV 138 M-2 remain similar to the existing ARALDITE® AV 138 M-1.

The following comparative report shows data obtained from laboratory testing of the new ARALDITE® AV 138 M-2 / HV 998-1 adhesive system against the existing ARALDITE® AV 138 M-1 / HV 998-1 system.

## TEST RESULTS

Unless otherwise stated, the figures given below were determined by testing standard specimens made by lap-jointing 100 x 25 x 1.6 mm strips of sandblasted aluminium alloy. The bond area was 12.5 x 25 mm, with bonded specimens cured under light clamping pressure. Lap shear testing was carried out at 23°C at 10mm/min unless indicated otherwise.

### Liquid properties

|                              | ARALDITE® AV 138 M-1 / HV 998-1      | ARALDITE® AV 138 M-2 (LME 11902) / HV 998-1 |
|------------------------------|--------------------------------------|---------------------------------------------|
| Mix Ratio (resin : hardener) | 100:40 by weight<br>100:40 by volume | 100:40 by weight<br>100:40 by volume        |
| Appearance (mix)             | Dark grey paste                      | Dark grey paste                             |
| Viscosity (mix)              | Thixotropic                          | Thixotropic                                 |
| Working time (10g) 23°C      | 65 minutes                           | 75 minutes                                  |

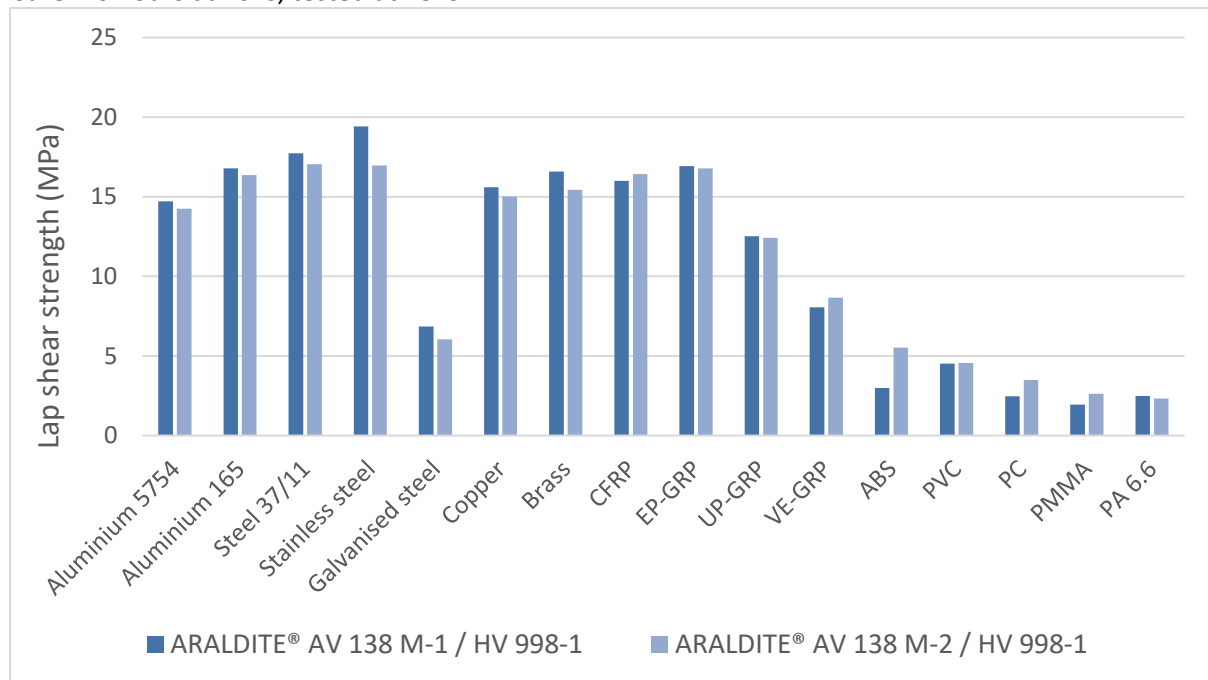
### Handling/working strength

Time to reach handling strength (1 MPa) and working strength (10 MPa) on bonded specimens cured at different temperatures.

| Cure temperature | Time to reach lap shear strength | ARALDITE® AV 138 M-1 / HV 998-1 | ARALDITE® AV 138 M-2 / HV 998-1 |
|------------------|----------------------------------|---------------------------------|---------------------------------|
| Curing at 15°C   | Time to 1 MPa                    | 7 hours                         | 8 hours                         |
|                  | Time to 10 MPa                   | 14 hours                        | 14 hours                        |
| Curing at 23°C   | Time to 1 MPa                    | 4 hours                         | 5 hours                         |
|                  | Time to 10 MPa                   | 6 hours                         | 7 hours                         |
| Curing at 40°C   | Time to 1 MPa                    | 1 hour                          | 1 hour                          |
|                  | Time to 10 MPa                   | 1.5 hours                       | 1.5 hours                       |

## Lap shear strength (LSS) on different materials (ISO 4587)

Cure: 16 hours at 40°C, tested at 23°C

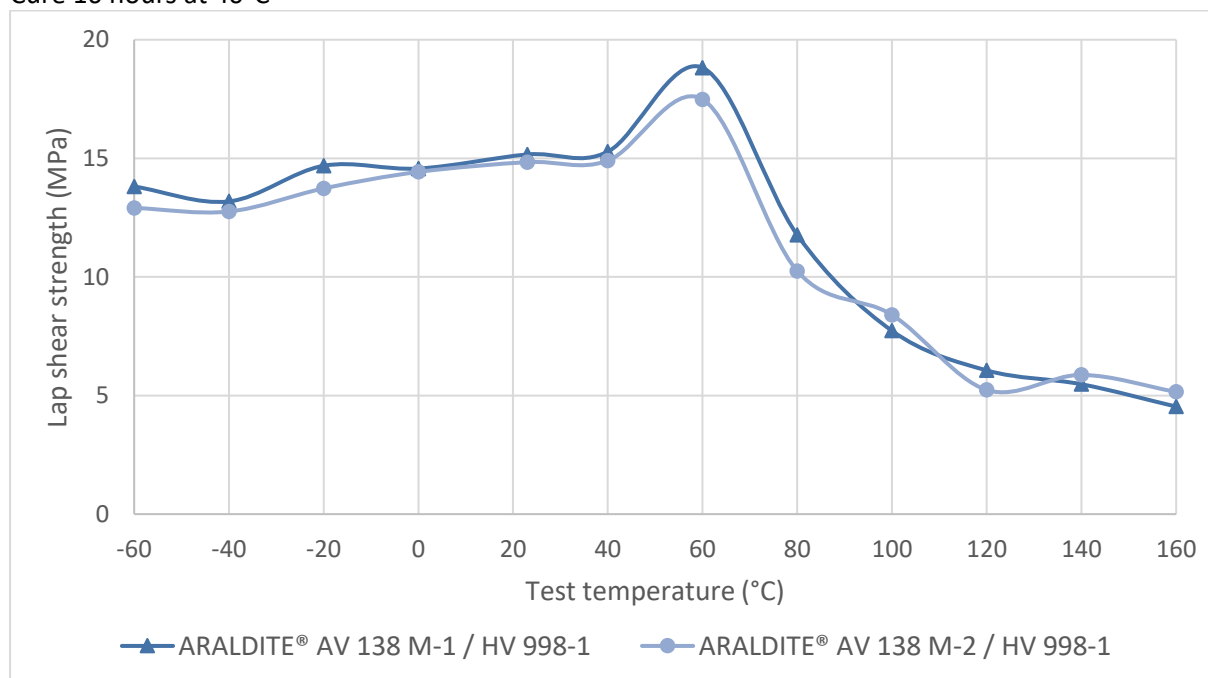


*Metal substrates: sandblasted & degreased with acetone (galvanised steel – acetone degrease only)*

*Plastic substrates: abraded & degreased with isopropanol*

## Lap shear strength versus temperature (ISO 4587)

Cure 16 hours at 40°C



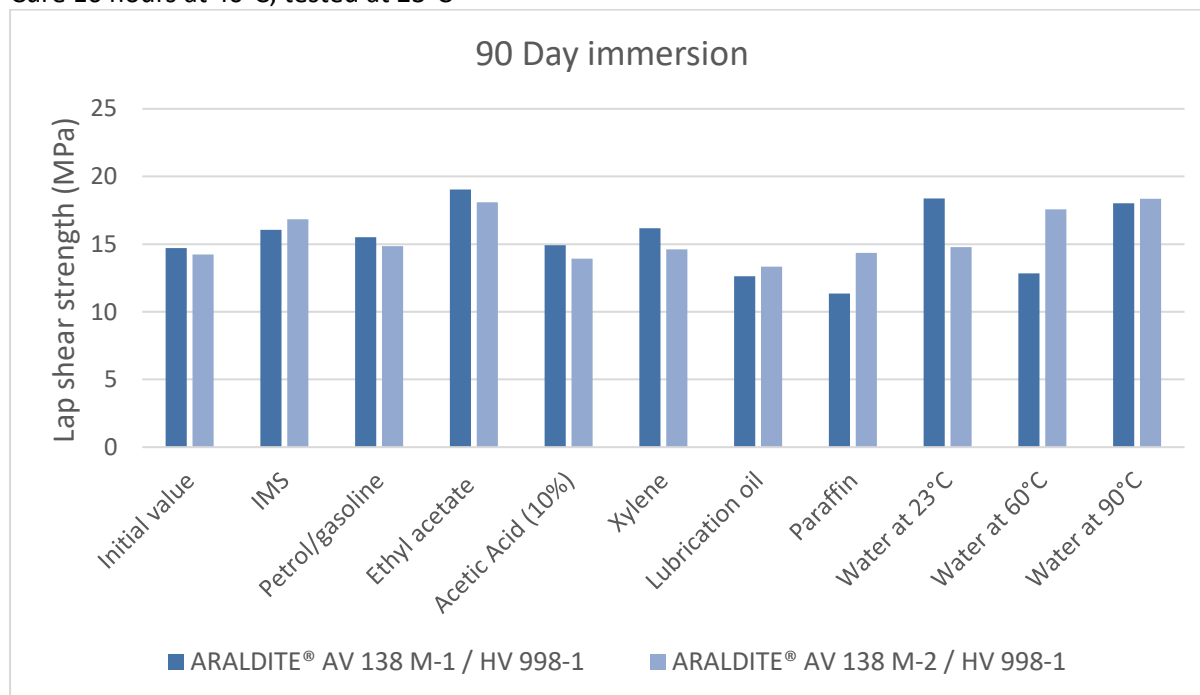
## DMA measurement (ISO 6721)

Cure 16 hours at 40°C

|                       | ARALDITE® AV 138 M-1 / HV 998-1 | ARALDITE® AV 138 M-2 / HV 998-1 |
|-----------------------|---------------------------------|---------------------------------|
| T <sub>g</sub> (Tanδ) | 70°C                            | 69°C                            |
| Shear modulus (23°C)  | 1750 MPa                        | 1910 MPa                        |

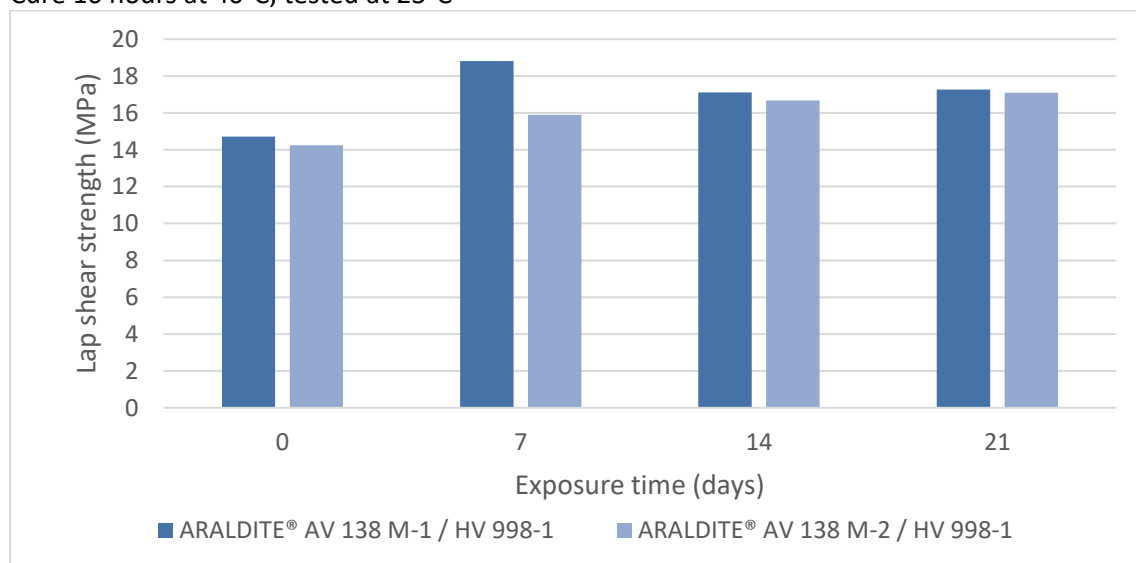
## Chemical aging - immersion in different media

Cure 16 hours at 40°C, tested at 23°C



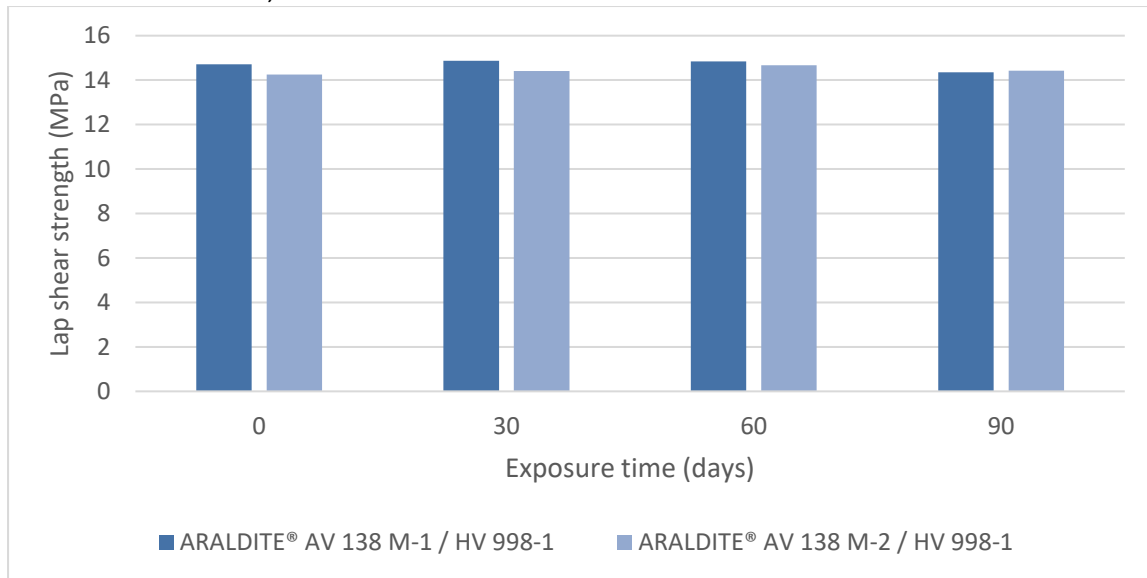
## Cataplasma aging (ISO 9142 E2)

Cure 16 hours at 40°C, tested at 23°C



### Heat aging at 70°C

Cure 16 hours at 40°C, tested at 23°C



### Tensile properties (ISO 527)

Cure 16 hours at 40°C, tested at 23°C

|                                 | Tensile modulus (MPa) | Tensile strength (MPa) | Elongation at break (%) |
|---------------------------------|-----------------------|------------------------|-------------------------|
| ARALDITE® AV 138 M-1 / HV 998-1 | 4474                  | 42                     | 1.1                     |
| ARALDITE® AV 138 M-2 / HV 998-1 | 4828                  | 43                     | 1.1                     |

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## CONCLUSION

Testing indicates that the ARALDITE® AV 138 M-2 / HV 998-1 offers similar handling and properties to the ARALDITE® AV 138 M-1 / HV 998-1. For many applications, it may be possible to replace ARALDITE® AV 138 M-1 / HV 998-1 with ARALDITE® AV 138 M-2 / HV 998-1 without a change of process conditions or part design. However, it is always recommended to check the suitability of the product for the intended application.

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**Huntsman Advanced Materials**  
(Switzerland) GmbH  
Klybeckstrasse 200  
4057 Basel  
Switzerland

Tel: +41 (0)61 299 11 11  
Fax: +41 (0)61 299 11 12

[www.aralditeadhesives.com](http://www.aralditeadhesives.com)