Temperature Test Report

SCIGRIP 400LSE

LOW SURFACE ENERGY ADHESIVE

TWO PART MMA

Application Description

Low surface energy (LSE) substrates are notoriously difficult to bond. These substrates have a low affinity for other substances which result in poor wetting properties. As a result, traditional adhesives often fail to adhere to these substrates securely. To overcome this, several strategies can be employed including surface treatment, primer or adhesion promoter and mechanical bonding. Unfortunately, these strategies add time, cost and weight or design restrictions to the project.

Speciality adhesives are a way to overcome these challenges, increase process efficiency, lightweight and improve aesthetics. The ability to bond a wide variety of materials is integral realising innovative design possibilities.

SG400LSE is a new product designed to overcome the bonding challenges of low surface energy plastics.

In these tests we plan to collect data on the adhesive's suitability for use in applications that involve exposure to different temperatures. The information is valuable in determining the appropriate adhesive for specific temperature-sensitive applications.

Overall, temperature testing of methyl methacrylate adhesive using lap shear strength tests provides important insights into the adhesive's performance under various temperatures, helping to ensure the reliability and durability of bonded assemblies.

Scope of Testing

7 sets of lap shears were prepared with T6082 Aluminium and 7 sets with polypropylene, then left for 24 hours to cure.

Each set of samples were conditioned for 1 hour to the following temperatures before being tested for lap shear strength at that temperature.

- -40°C
- -15°C
- 30°C
- 40°C
- 50°C
- 60°C
- 70°C
- 80°C

Test Methods

ASTM D1002	Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
ASTM D3163	Standard Test Method for Determining Strength of Adhesively Bonded Rigid Plastic Lap-Shear Joints in Shear by Tension Loading

SG400LSE was used to prepare all samples.

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Results

Table 1. Polypropylene

Temperature	Mean Shear Strength (MPa)	Failure Mode
-40°C	3.74	Substrate Break
-15°C	3.2	Substrate Break
30°C	2.41	Substrate Break
40°C	2.86	Substrate Break
50°C	2.41	Substrate Break
60°C	2.03	Substrate Break
70°C	1.69	Stopped/Stretched
80°C	1.43	Stopped/Stretched

Table 2. T6082 Aluminium

Temperature	Mean Shear Strength (MPa)	Failure Mode (Adh/Coh/Sub)
-40°C	8.22	0/100/0
-15°C	8.96	0/100/0
30°C	5.03	0/100/0
40°C	4.70	0/100/0
50°C	4.68	0/100/0
60°C	3.96	0/100/0
70°C	4.04	0/100/0
80°C	3.54	50/50/0

Observations & Conclusions

While the polypropylene lap shear strength decreases as the temperature increases, the failure mode is consistent with substrate failure on all samples. This indicates that the temperature change is having a greater effect on the substrate than on the adhesives. The adhesive never failed in this test.

Testing is performed on aluminum to eliminate the substrate influence and see what the ultimate strength of the adhesive is. The aluminum lap shear strength decreases as the temperature increases, as we would expect. However, the break strength of the polypropylene homopolymer tested is 3.8MPa so SG400 still has reasonable strength at 80°C. At temperatures greater than 70°C, the failure begins to change with some adhesive failure beginning to occur.

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