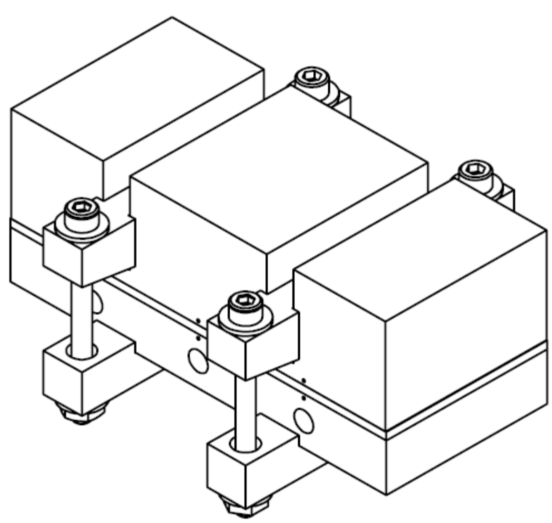
Tputty 403 Thermal Reliability Report

Summary
The Laird Technologies gap filler reliability test procedure has been designed to characterize the long-term performance of a gap filling material while being subjected to isothermal conditions, sudden repeated extremes in temperature, and moderate heat - high humidity environments. Specimens are placed within application-related fixtures under set conditions and at regular intervals the thermal properties of the specimens are measured.

Fixture Setup
The test fixture is rectangular with dimensions of 2” x 5” (surface area of 10 in^2). It consists of an aluminum heater plate and an extruded aluminum heat sink “cooler plate”. The heater plate contains 3 holes for insertion of cartridge heaters. Both plates contain 3 sets of thermocouple holes drilled for measurement of the temperature very near the surfaces mated by the gap pad. Each test fixture accommodates 3 test positions. The heater and cooler plates are held together by metal straps which span the width of the plates (2 sets per test fixture) and are bolted to each other. In the case of gap fillers in putty form, spacers are used to hold constant thickness throughout the test. Cartridge heaters are inserted into the heater plate holes. A specified power from a power supply is input to the heaters to obtain a constant 70^0C across the heater plate. This ensures a constant heat flow is maintained through the gap filler during data acquisition. A cooling fan is centered on top of the heat sink during testing to facilitate realistic air flow and cooling. Test values are measured in an ambient laboratory environment.



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Theory

Temperature difference between the surfaces of the heater and cooler plates are monitored throughout the test. Thermal resistance (R_{th}) is the temperature difference (ΔT) between two surfaces for a given heat flow (ΔP). That is: $R_{th} = \Delta T / \Delta P$. In this procedure, heat flow is controlled and constant, therefore, $R_{th} \alpha \Delta T$. This relationship indicates that a constant value of ΔT throughout the test program requires R_{th} to also remain constant, indicating a highly reliable system and thus, a gap filler which is not influenced by the test conditions.

Types of Reliability Testing

Thermal Shock

In thermal shock aging, test fixtures containing the specimens were transitioned between two chambers with temperatures set at -40 ^{o}C and 125 ^{o}C. The holding time in each chamber was 30min and the transition time between the two chambers was typically less than 20 seconds.

Isothermal Bake

In isothermal aging, fixtures were maintained at 150 ^{o}C.

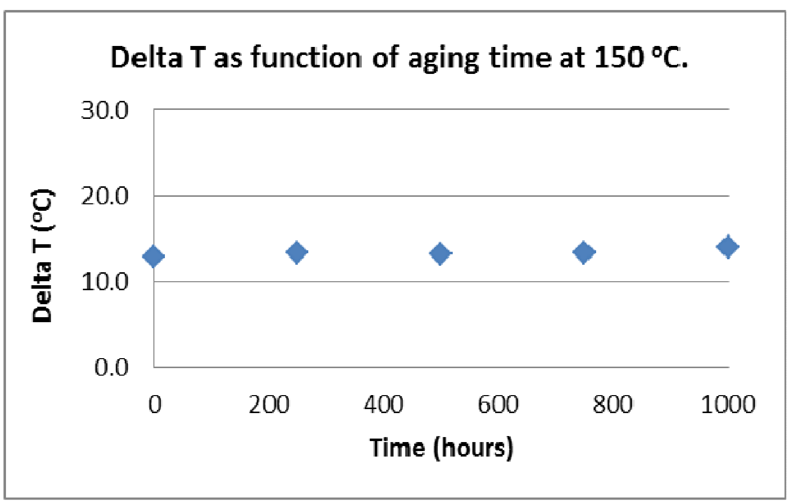
HAST

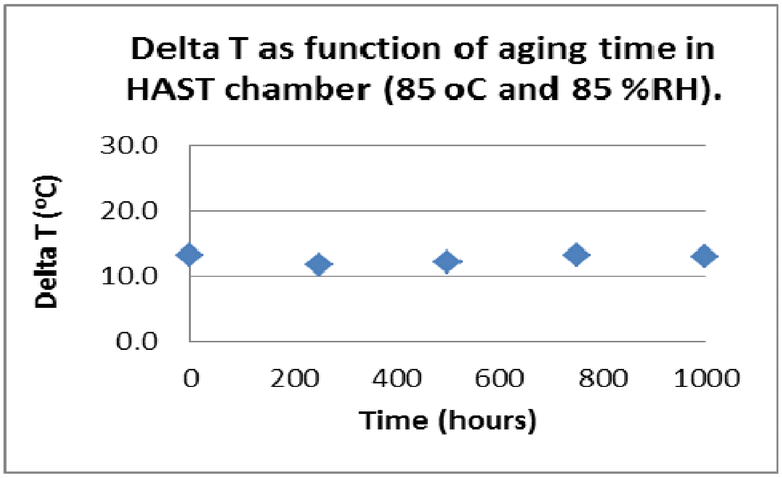
In HAST aging, fixtures were maintained in conditions of moderate temperature (85^{0}C) and high humidity (85%).

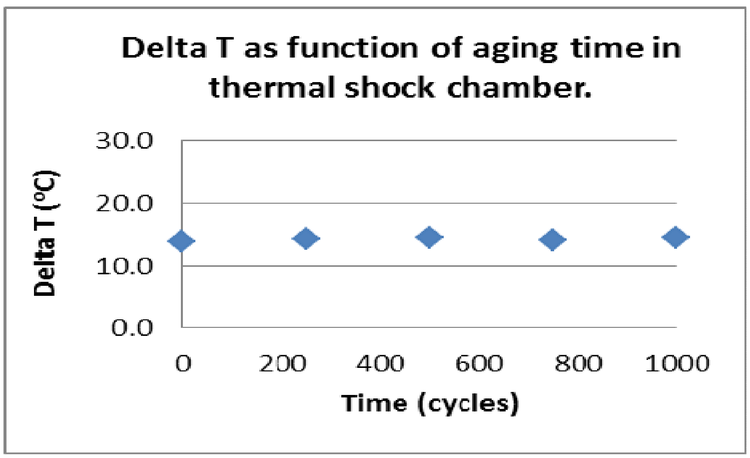
Results

The thickness of Tputty 403 tested in all conditions was 45mil. Two fixtures were used for each aging condition. There were three test positions for each fixture. The data reported is the average of six results for the two fixtures.

The change in temperature (ΔT) versus time or number of cycles tested is reported as below.







Conclusion:

The graphs above show that measured delta T was stable under the aging conditions for Tputty 403. Based on this data, no thermal degradation was evidenced and therefore, it is shown that Tputty 403 will continue to perform as designed in applications under harsh environmental conditions similar to those tested.