

Reliability Report: Secure™ 1500FG Adhesive

Material: Secure™ 1500FG, Protect™ 1500FG

The Secure™ Adhesive was evaluated to determine the overall reliability of the material. The following environmental conditions were part of this evaluation:

1. Thermal Aging at 150°C for 1000 hours
2. Hydrolytic Aging at 85°C and 85% relative humidity for 1000 hours
3. Thermal Shock Cycling from -40°C to 150°C, for 1000 cycles

The properties that were tested as part of this study are as follows:

1. Thermal resistance - non-destructive test method
2. Hardness – non-destructive test
3. Dielectric breakdown voltage - destructive test method
4. Lap shear strength - destructive test method

Test Methods/procedures:

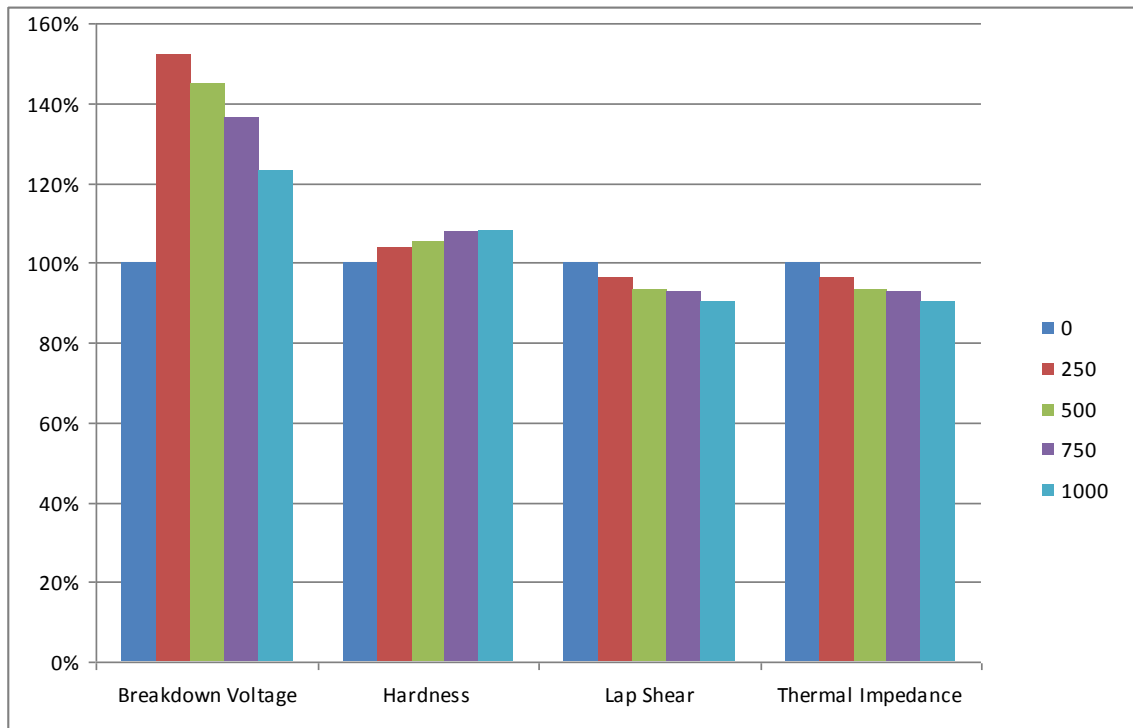
1. Thermal resistance
 - a. Samples of the material only were subjected to thermal and hydrolytic aging. Thermal impedance of the material was measured according to ASTM D5470 test method. Thermal impedance was measured on six specimens at each interval and set of conditions.
 - i. Figure 1: Thermal Aging at 150°C for 1000 hours.
 - ii. Figure 2: Hydrolytic Aging at 85°C and 85% relative humidity for 1000 hours.
2. Hardness
 - a. 0.250 inch thick samples of the silicone rubber compound only subjected to thermal and hydrolytic aging. The material hardness was tested using a Shore-A hardness tester according to ASTM D2270. The hardness was tested at ten points on five specimens at each interval and set of conditions.
 - i. Figure 1: Thermal Aging at 150°C for 1000 hours.
 - ii. Figure 2: Hydrolytic Aging at 85°C and 85% relative humidity for 1000 hours.
3. Dielectric breakdown Voltage
 - a. Samples of the material only were subjected to thermal and hydrolytic aging. The dielectric breakdown voltage was measured according to ASTM D149 with a 6 mm probe. Dielectric breakdown voltage was measured ten times at each interval and set of conditions.
 - i. Figure 1: Thermal Aging at 150°C for 1000 hours.
 - ii. Figure 2: Hydrolytic Aging at 85°C and 85% relative humidity for 1000 hours.
 - b. Samples of TO-220 transistors bonded to 1 in. x 6 in. x 0.062 in. T-6061 aluminum coupons were subjected to thermal shock cycling. The dielectric breakdown voltage was measured according to ASTM D149 with a 6 mm probe that contacted to metal tab of the TO-220 and aluminum coupon. Dielectric breakdown voltage was measured twenty times at each interval.
 - iii. Figure 3: Thermal Shock Cycling from -40°C to 150°C, for 1000 cycles.
4. Lap Shear Strength
 - a. Samples of the material were bonded between two 1 in. x 6 in. x 0.062 in. T-6061 aluminum coupons in a single lap configuration. Total bond area was one (1) in². The lap shear coupons were cured for 15 minutes at 121°C (total time including tooling lag). The shear strength was measured according to ASTM D1002. The lap shear strength was measured on seven specimens at each interval and set of conditions.
 - i. Figure 1: Thermal Aging at 150°C for 1000 hours.
 - ii. Figure 2: Hydrolytic Aging at 85°C and 85% relative humidity for 1000 hours.
 - b. Samples of TO-220 transistors bonded to 1 in. x 6 in. x 0.062 in. T-6061 aluminum coupons were subjected to thermal shock cycling. The lap shear coupons were prepared by tacking the TO-220 transistor at 85 PSI for 30 seconds followed by open air curing for 10 minutes at 150°C. The lap shear strength was measured according to ASTM D1002 modified with a fixture used to apply force

to the TO-220 transistor in shear. The lap shear strength was measured on twenty specimens at each interval.

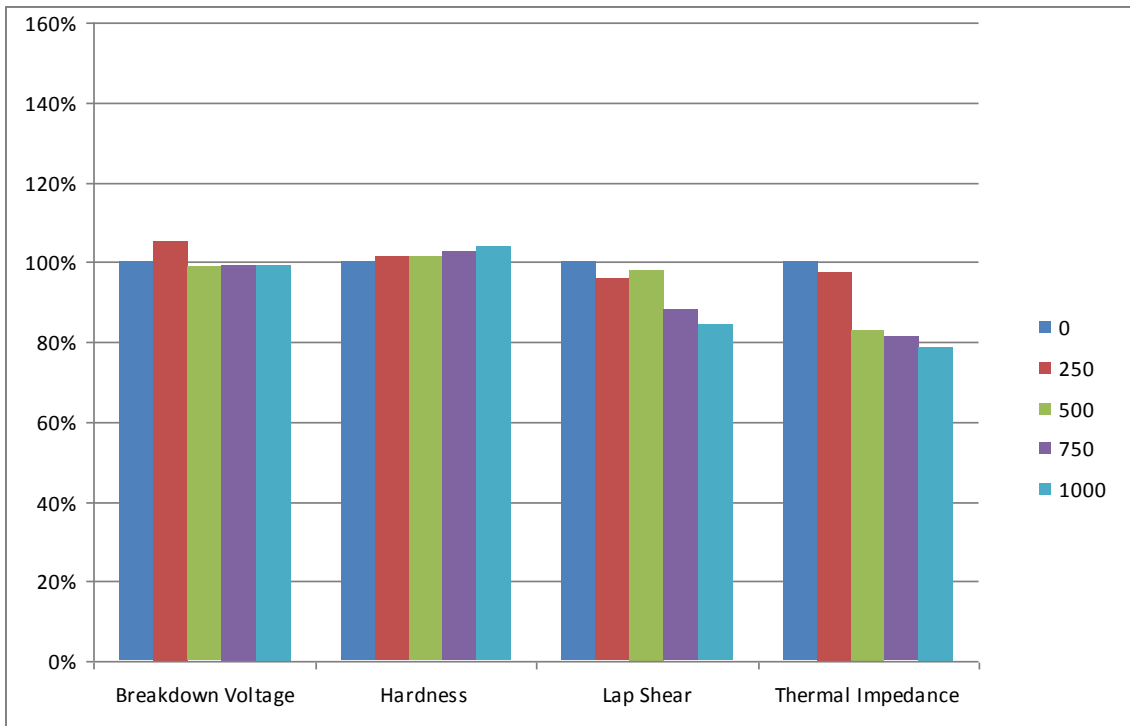
- i. Figure 3: Thermal Shock Cycling from -40°C to 150°C, for 1000 cycles.
- c. Samples of the material were bonded between one 1 in. x 4 in. x 0.062 in. T-6061 aluminum coupon and a 1 in. x 4 in. x 0.062 in. copper, aluminum, epoxy, or copper clad epoxy coupons in a single lap configuration. Total bond area was one (1) in². The lap shear coupons were cured for 15 minutes at 121°C (total time including tooling lag). The shear strength was measured according to ASTM D1002. The lap shear strength was measured on seven specimens at each interval and set of conditions.
 - i. Figure 4: Thermal Shock Cycling from -40°C to 150°C, for 1000 cycles.

Test Results:

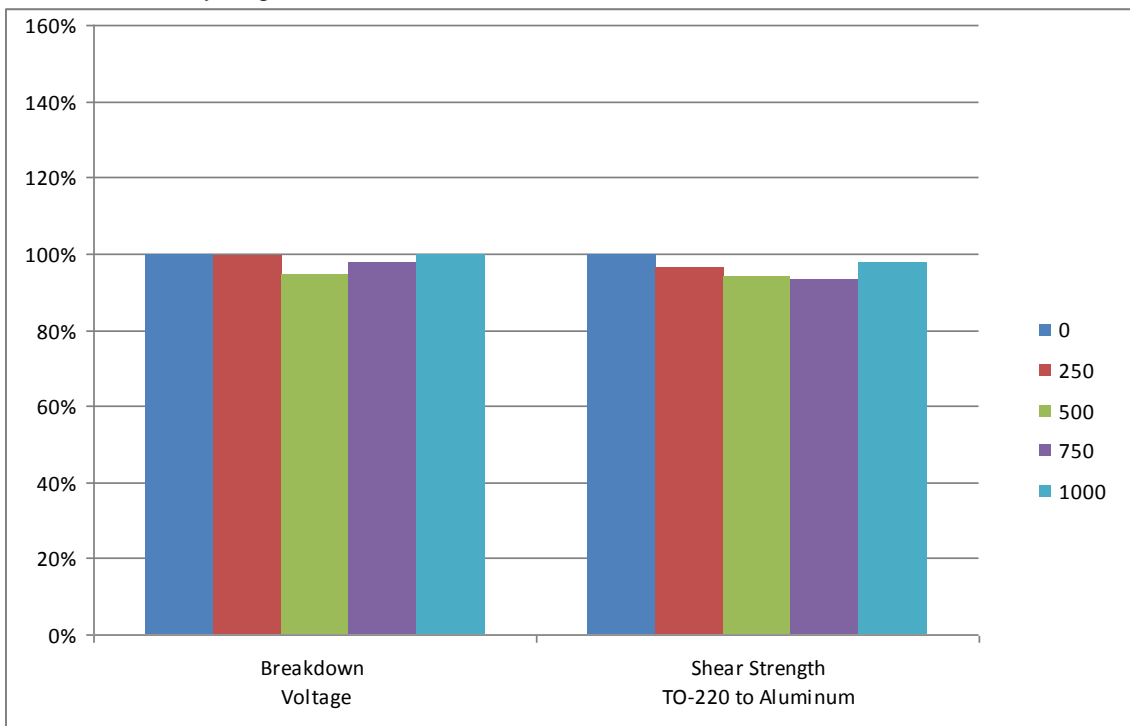
1. Thermal Aging at 150°C for 1000 hours:



2. Hydrolytic Aging at 85°C and 85% relative humidity for 1000 hours



3. Thermal Shock Cycling from -40°C to 150°C – TO-220/Aluminum



4. Thermal Shock Cycling from -40°C to 150°C – Aluminum/Various Surfaces

