New silicone adhesive technology for fast assembly applications in electronics

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Agenda

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- Introduction
- Hot-Melt Technology
- Experimental Work
- Conclusions
- Q & A

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- Yongguang Lee, Lab Technician
- Yi Fan, Lab Technician

Market Trends

- The demand for slimmer, lighter, and more powerful devices increases the complexity of the designs.
- Need for assembly together numerous parts quickly and durably during manufacture.
- High-performance adhesives that can quickly bond.

Silicone Adhesives Attributes

- Thermal stability
- Flexibility
- Moisture Resistance
- Adhesion to many common substrates
- Low ionic impurity
- Compatibility with common processing techniques.

Silicone Adhesive Alternatives

- Moisture cure (RTV): low cost, simple dispensing equipment and process, no heating required, and robust cure chemistry.
- Platinum Cure: Heat curing, long working time, one or two part formulations.

Current demands from the industry dictates the requirement for a fast bonding development.

Silicone Hot-Melt Adhesive

- Incorporates the typical benefits of silicones, with the ability to generate instant green strength which allows a fast assembly operation.

Hot-Melt Technology

- 100% solids formulations (thermoplastic polymers).
- Solid at room temperature.
- Activated upon heating (liquid dispensed).
- They retain the ability to wet the substrate until they solidify at the time they cool down.
- Upon solidification, they return to a physical state that has structural integrity and can function as an adhesive.

Hot-Melt Technology Cont...

- On cooling, hot-melts rapidly build up their internal strength allowing rapid assembly and further processing.
- Thermoplastic polymers: can be repeatedly heated to melt and cooled to solidify. This property limits the temperature resistance.
- Tendency to creep when subjected to continuous stress or elevated temperatures.

Silicone Hot-Melt Adhesive

- Silicone hot melt adhesives are a subset of hot melts adhesives where crosslinking of the silicone polymer component will yield an end-product that is physically stable over a wide temperature range.

Silicone Hot-Melt Adhesive

- Silicone hot melt adhesive undergoes a moisture cure reaction that causes the adhesive to crosslink forming a new structure that provides high strength and flexibility.
- Reactive silicone hot melts are heat resistant and can be used in heat sensitive applications.

Experimental Work

Performance of silicone hot-melt formulation was evaluated through lap shear adhesion test (ASTM D1002):

- Initial Green Strength
- Adhesion Strength to different Substrates
- Thermal Stability: High temperature exposure (120 and 150 °C); Damp heat (85 °C/ 85% RH); Thermal shock (-40 to 125 °C)
- Fluid Immersion
- Salt Spray

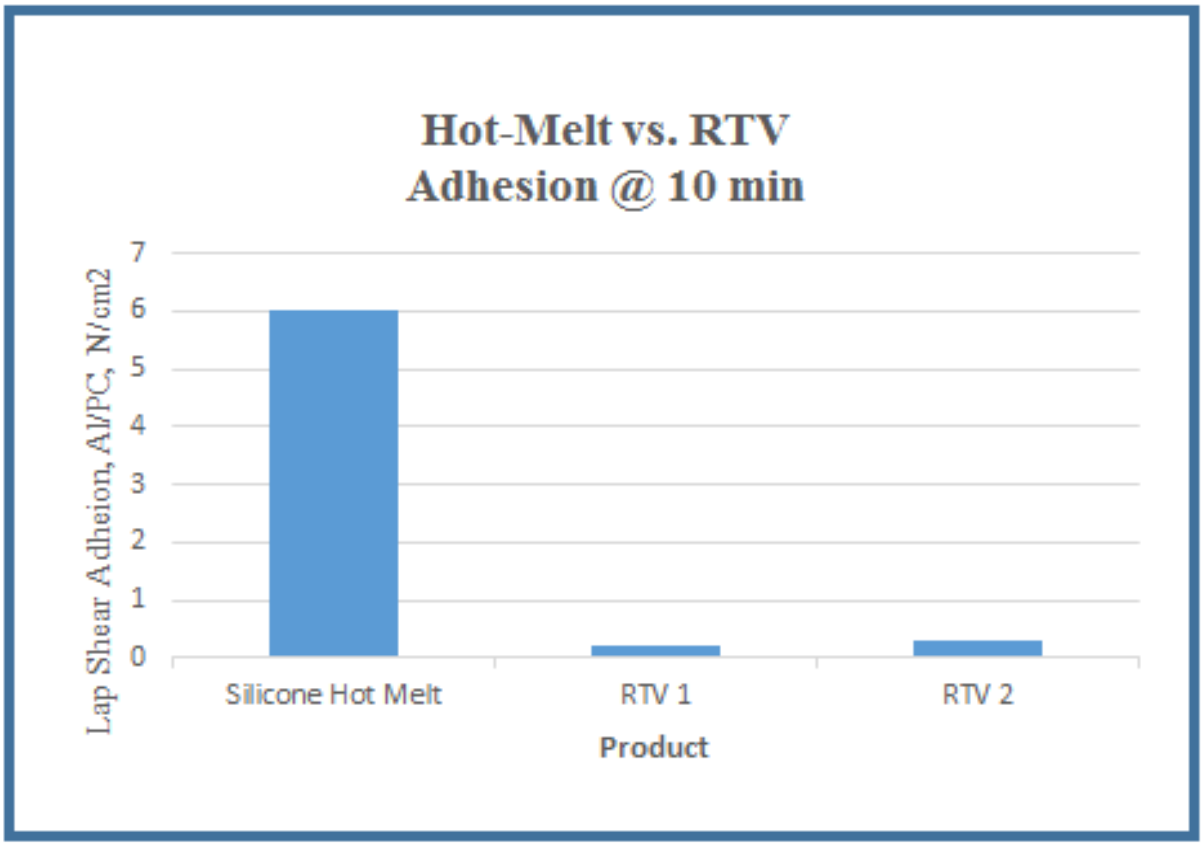
Hot- Melt Formulation

Silicone Hot Melt Adhesive

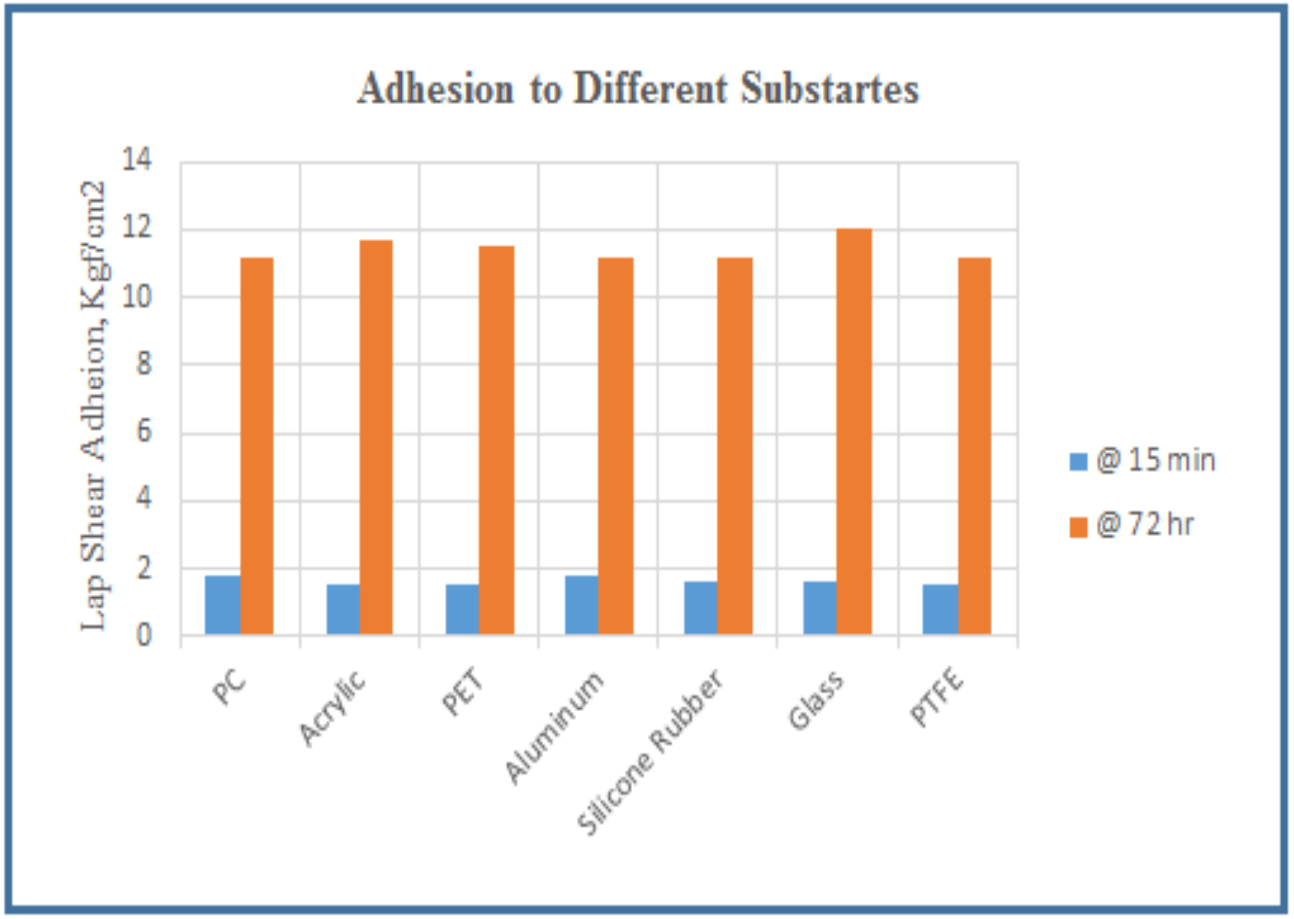
Physical Properties

Appearance/Color	Black
Viscosity @ 120 °C, Pa-s	60
Specific Gravity	1.08
Hardness, Shore A	55
Tensile Strength, MPa	4.6
Elongation, %	1000
Dielectric Strength, volts/mil	490

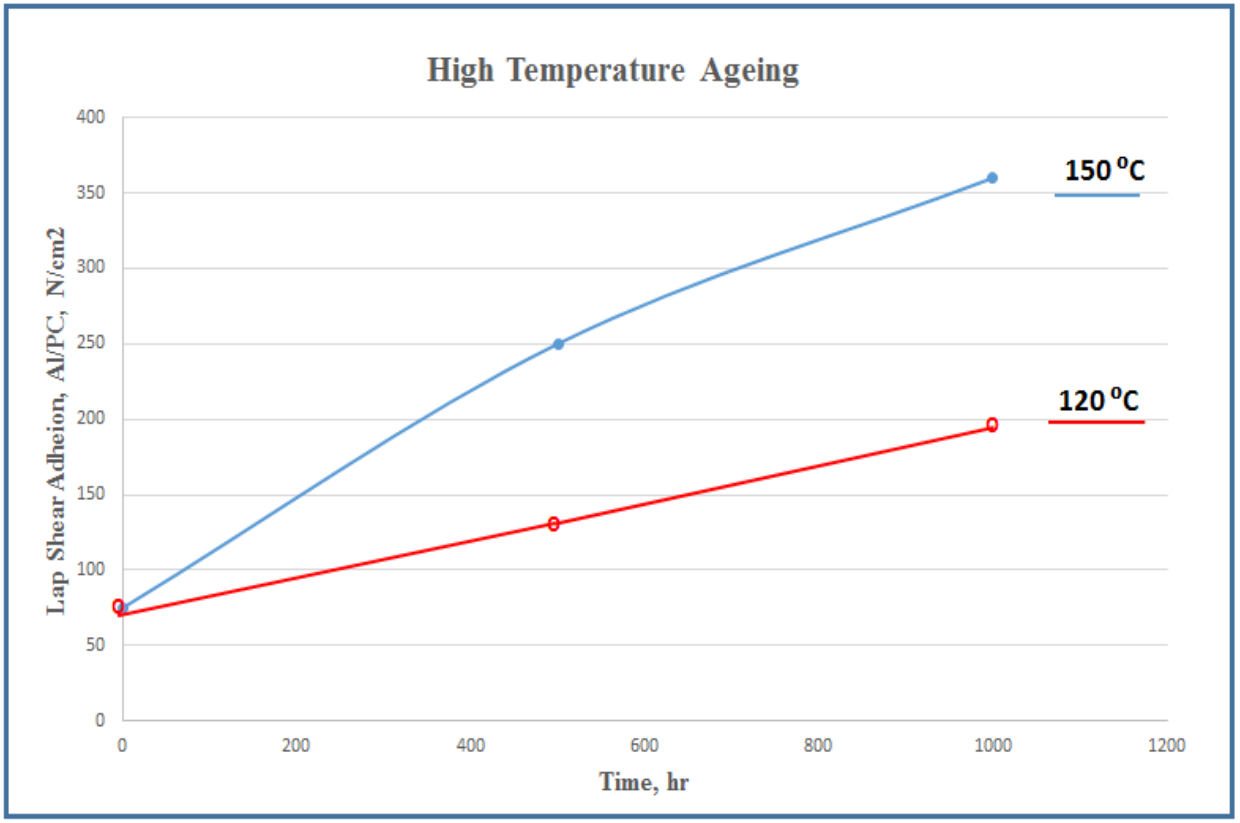
Initial Green Strength



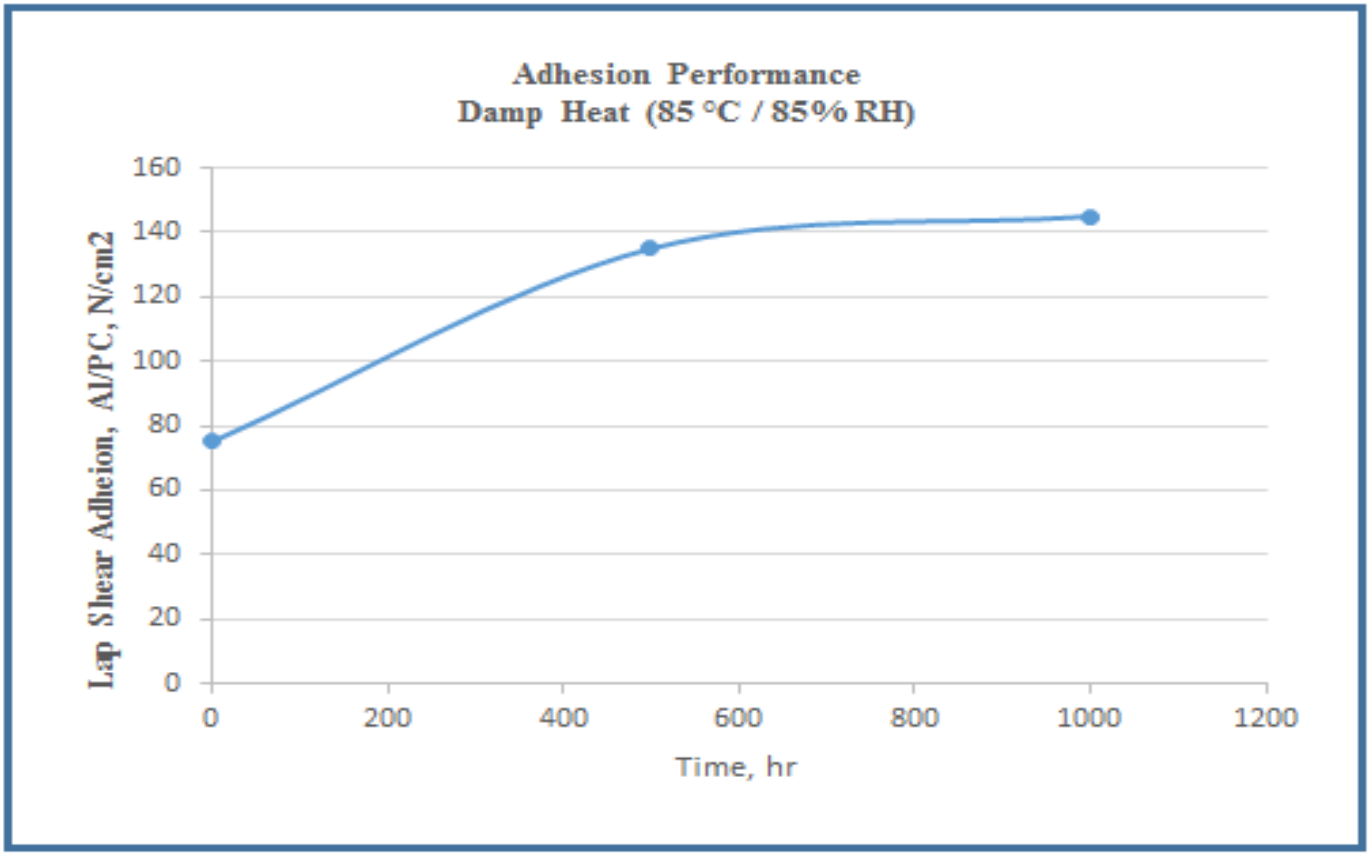
Adhesion to Different Substrates



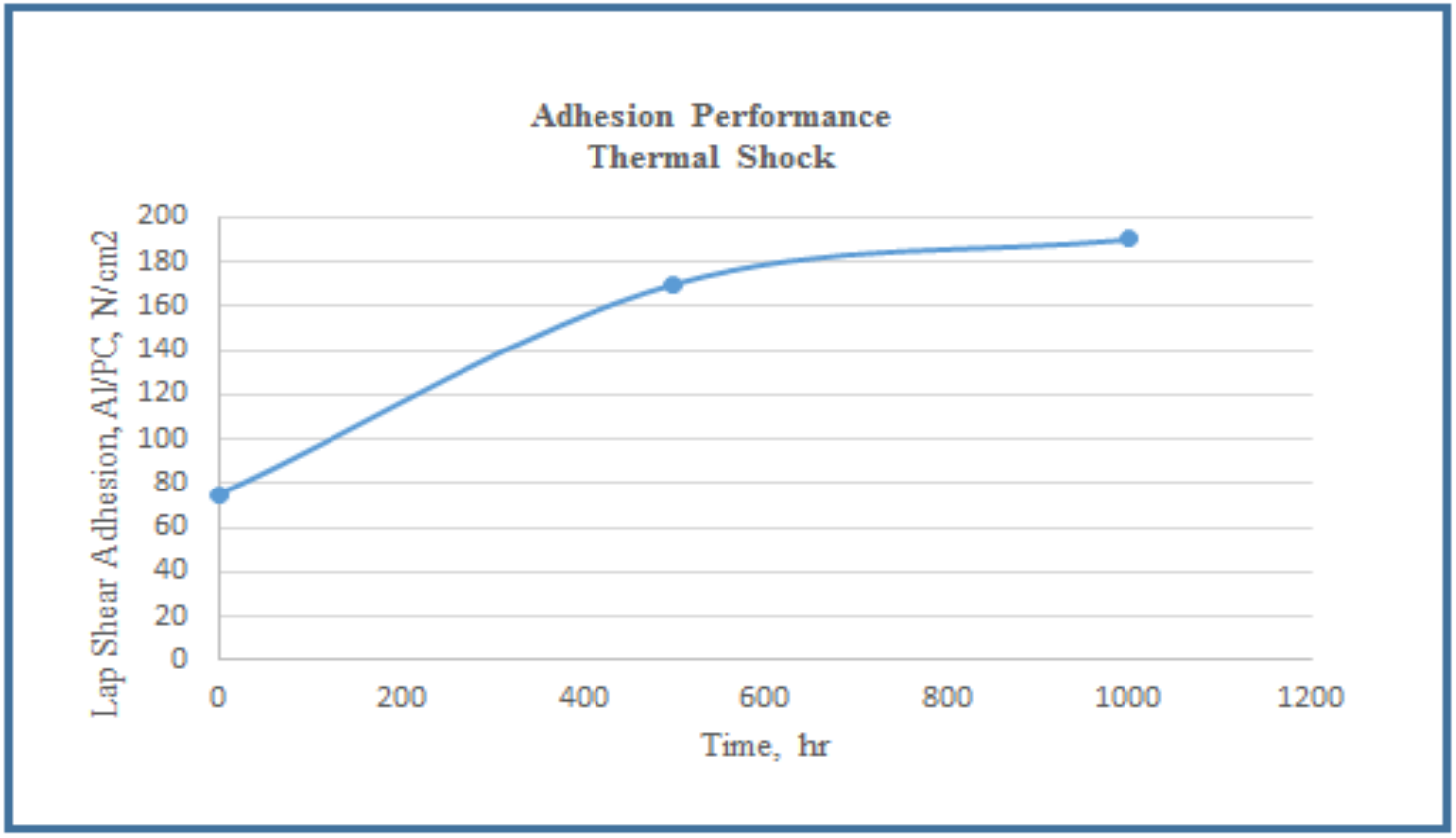
High Temperature Ageing



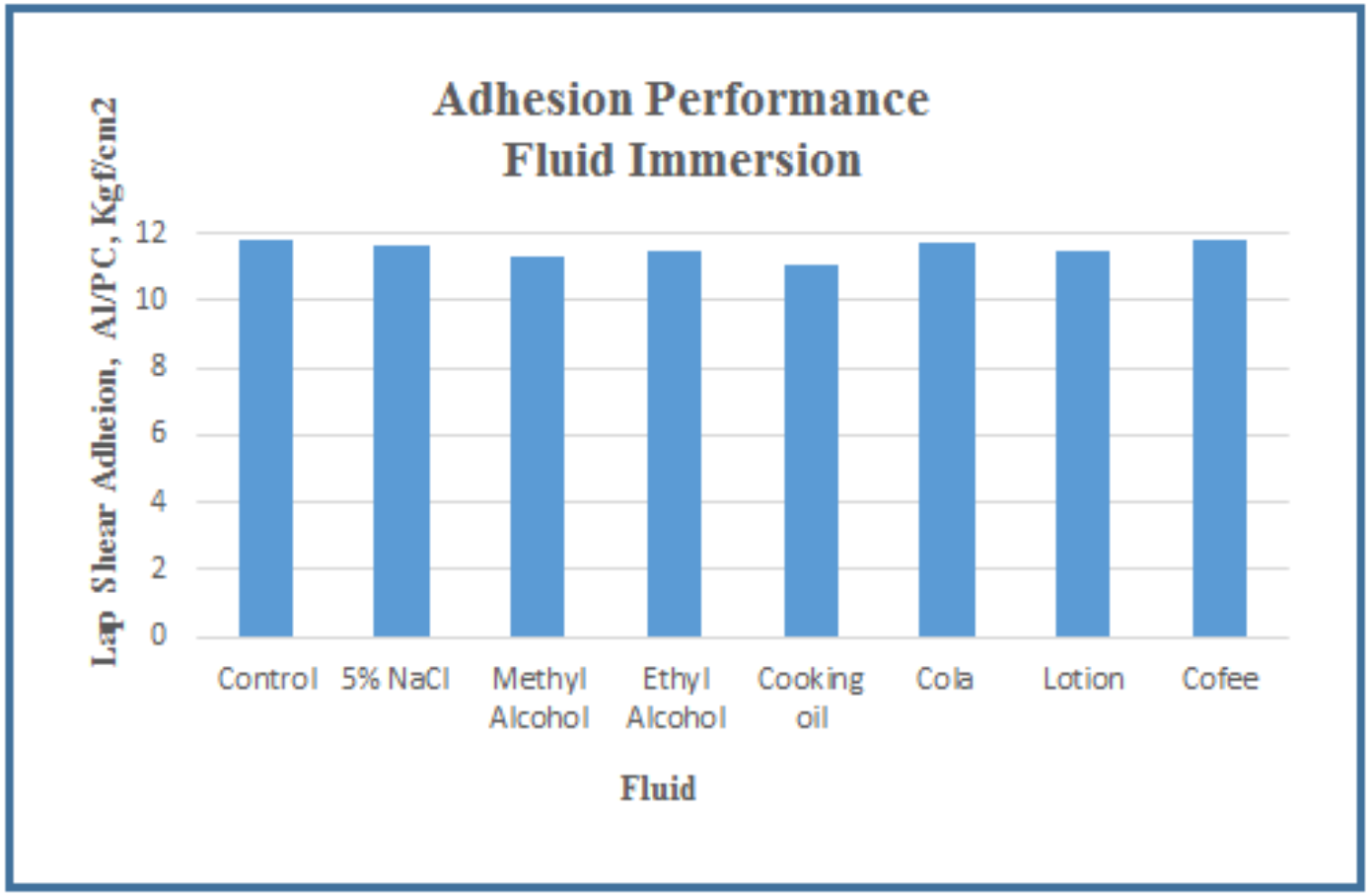
Damp Heat (85 °C / 85% RH)



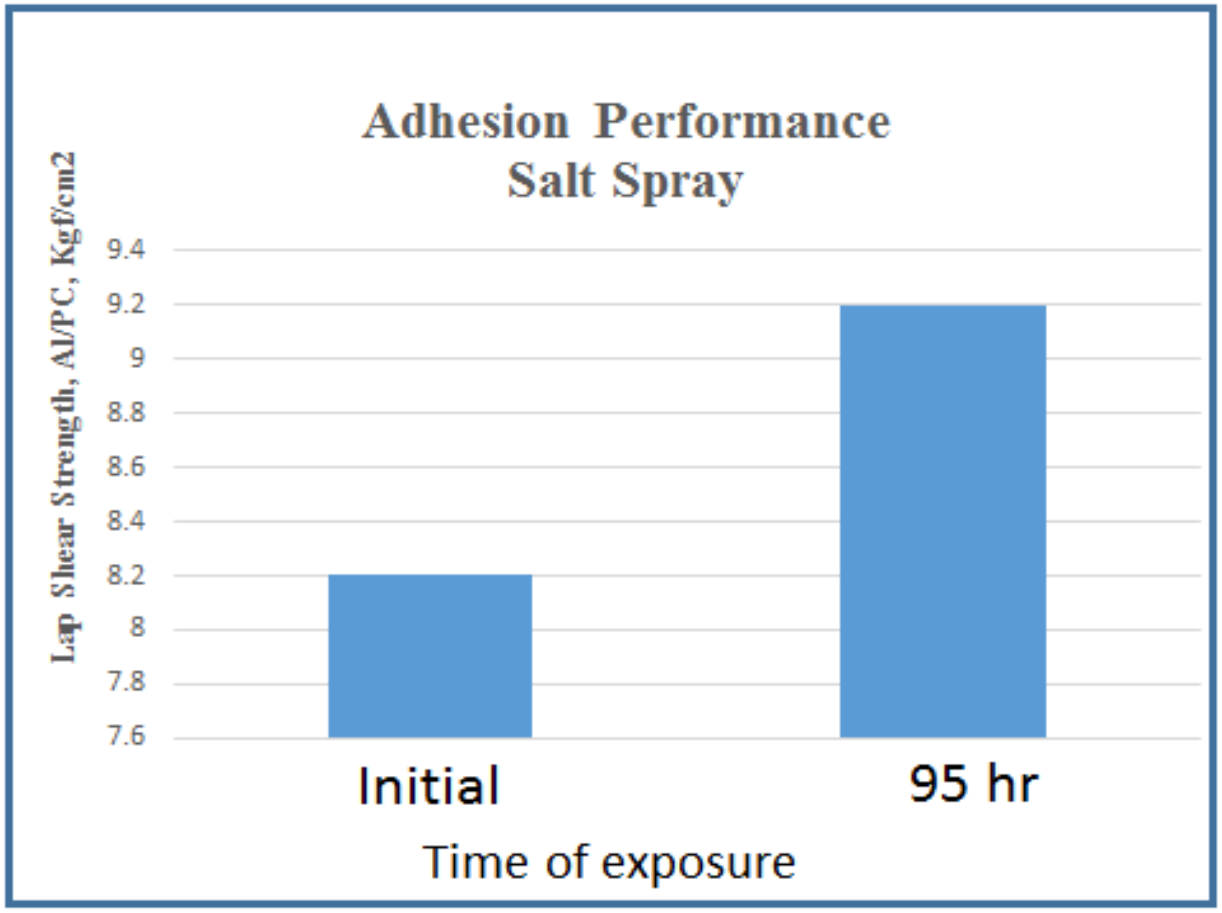
Thermal Shock (-40 / 120 °C)



Fluid Immersion



Salt Spray (5% NaCl)



Conclusion

- The silicone hot melt adhesive has proven good performance after been evaluated for several ageing conditions: Damp heat (85 °C and 85% RH); Thermal shock (-40 – 85 °C); High temperature (120 and 150 °C); Fluid immersion; and Salt spray.

Conclusion

- The silicone hot melt adhesive is dispensed at elevated temperature (125 °C). It reacts with ambient moisture to become a viscoelastic material with enhanced physical properties.
- It quickly achieves green strength - within minutes - .
- Primerless adhesion to common substrates (including low surface energy plastics).

The data reported in this paper should be used as a reference to establish general performance of the silicone hot-melt adhesive under different conditions. Any specific application will require extensive testing and evaluations to determine the applicability of the product, taking into consideration: geometry of the part, operating conditions and environmental factors.

SMTA International

SMTA
Surface Mount Technology Association
MEXICO

Thank you!

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