# Choosing silicones for harsh thermal environments

Silicones have been used as adhesives and sealants in aircraft and aerospace applications for decades. Their unique properties allow them to maintain their function in extreme heat and cold while absorbing stress between substrates with different coefficients of thermal expansion (CTE) rates during thermal cycling.

In extreme environments, materials tend to break down or crack from long-term heat exposure or become brittle when exposed to extremely low temperatures. For satellites and other space applications, there is added risk of silicone contamination from thermal cycling where volatile compounds evaporate when heated under low pressure then condense onto cooler surfaces.

NuSil® brand's high purity, low outgassing silicones for extreme temperatures are formulated to specifically mitigate the risk of contamination in these types of applications. They feature properties to ensure silicones maintain elasticity and resist breakdown during thermal cycling.

We understand that processing silicones can be as challenging as the environments, so our portfolio includes a variety of options with different viscosities and curing options.

## SOLUTIONS FOR EXTREME ENVIRONMENTS

- **High Temperatures:** Maintain desired properties in temperatures up to 250°C continuous and 300°C intermittently.
- **Cold Temperatures:** Silicones designed for broad operating temperatures remain flexible at lower temperatures compared to traditional silicones. These silicones typically have a glass transition (Tg) temperature in the range of -115°C to -120°C.
- **Fuel Resistance:** Fluorosilicones are formulated to resist swelling when exposed to fuels and organic solvents and can be used in applications >200°C. Available as paints, one- and two-part adhesives, and moldable silicones.
- **Space Grade Silicones:** NuSil low outgassing and ultra-low outgassing portfolio of silicones includes those designed for broad operating temperatures and specialty applications >200°C. Available as coatings, adhesives, potting and conductive silicones.

## CONSIDERATIONS WHEN SELECTING A SILICONE FOR HARSH THERMAL ENVIRONMENTS

NuSil products are designed for specific applications and areas of use. These products can meet low outgassing requirements, withstand extreme temperature conditions, or maintain integrity when exposed to organic fuels and solvents. Each of these product families has a wide variety of options with additional technical information in the respective product guides. Using the finder below can help answer which product family is necessary for your unique application needs.


*The operating temperature range of a silicone in any application is dependent on many variables, including but not limited to temperature, time of exposure, type of atmosphere, exposure of the material's surface to the atmosphere, oxygen and mechanical stress. In addition, a material's physical properties may vary at both the high and low end of the operating temperature range. The user is responsible to adequately test and determine the safety and suitability for their application and NuSil makes no warranty concerning fitness for any use or purpose.

To learn more about silicones for harsh environments, visit **www.avantorsciences.com/nusil** or contact NuSil experts today at **silicone@avantorsciencesgcc.com** or **+1 (805) 684-8780**.

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