

Temperature Performance of Silicone Rubber Septa - Tech Information

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Silicone rubber is widely used as a septum material in autosampler vial caps due to its exceptional thermal resilience and pierceability.

In laboratory applications, silicone rubber used for septa maintains functional integrity across a broad temperature range of **-55 °C to 220 °C**, making it suitable for high-temperature analytical workflows such as headspace sampling and GC injection preparation.

However, the overall temperature tolerance of a vial-and-cap assembly depends not only on the septum but also on the cap material:

1. Performance in Polypropylene Caps

While silicone rubber tolerates temperatures up to 220 °C, polypropylene (PP) caps do not. PP begins to soften and lose mechanical stability at elevated temperatures, which may compromise the seal, cause thread deformation, or impact vial closure integrity.

Therefore, when caps are polypropylene, the upper functional limit of the entire system is effectively capped by the PP itself, not by the silicone septum.

2. Performance in Aluminum Caps

When silicone rubber septa are installed in aluminum caps, the assembly supports temperatures at the full upper range of silicone rubber (up to 220 °C). Aluminum remains dimensionally stable at these temperatures and does not contribute to seal failure or mechanical deformation.

This makes aluminum a preferred choice for high-temperature applications, including more aggressive headspace workflows.

3. Material Behavior at Extreme Temperatures

At temperatures approaching or exceeding 220 °C, silicone rubber may begin to harden and become brittle. Although this represents a change in physical characteristics, such extreme conditions are not encountered in typical autosamplers, including modern Headspace instruments, which operate well below this threshold.

As a result, brittleness is rarely a concern in practical chromatographic environments

4. Practical Implications for Lab Use

- Silicone/PTFE septa remain stable through standard thermal cycles used in headspace GC.
- High-temperature instrument methods should consider cap composition when selecting compatible supplies.
- For workflows requiring **maximum thermal tolerance**, aluminum caps provide the most reliable pairing with silicone rubber septa.
- Users should avoid exposing polypropylene-based caps to temperatures near their material limit to prevent cap distortion or compromised sealing.

Click [HERE](#) for Headspace Vials & Caps Ordering Information.

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