



Holds. Dampens. Protects.

Silane-Epoxy Adhesives

Collano RS 6400 and Collano RS 8505

The balanced combination of adhesion, energy absorption, and vibration damping ensures a high level of safety under real load conditions.

Engineered adhesives are expected to reliably bond different materials while withstanding tough conditions. They carry loads, endure temperature cycling, and resist environmental wear in applications where failure is not an option.

This overview highlights how Collano's advanced silane-epoxy adhesives combine reliable bonding with excellent toughness and shock resistance, offering a performance edge over common alternatives, particularly in demanding applications such as ballistic protection.

The two-component silane-epoxy adhesives Collano RS 6400 and RS 8505 are strong candidates for demanding niche applications.

They are particularly suited for ballistic protection systems, but also multi materials such as outdoor architectural elements that require both structural integrity and damping. To establish this positioning, these silane-epoxy adhesives were benchmarked against three reference adhesives representing distinct chemistries:

1. one-component reactive polyurethane (PUR)
2. two-component silane modified adhesive (of alternative formulation)
3. one-component reactive epoxy

Selected material properties were compared via the use of Ashby plots.

Damping and Elasticity

measured by Dynamic Mechanical Analysis (DMA) across a frequency range (10^{-3} bis 10^{12} Hz):

- The materials in the upper-left quadrant exhibit pronounced damping with modest stiffness, whilst those in the lower-right quadrant demonstrate high stiffness coupled with minimal damping character.
- The **Collano RS 6400** (■) and **Collano RS 8505** (■) adhesives fall within a mid range performance profile, combining good load bearing capability (structural bonding) with effective shock and vibration resistance (damping behaviour). This combination leads to a strong, durable, tough, and reliable bonding.
- The **one-component PUR adhesive** (■) and the **two-component silane modified adhesive** (■) demonstrate a pronounced viscoelastic behaviour and are very suitable for when damping characteristics are predominantly required, less suited when structural bonding is focussed on.
- The **one-component reactive epoxy adhesive** (■) demonstrates significantly lower damping properties and should be considered predominantly for structural bonding.

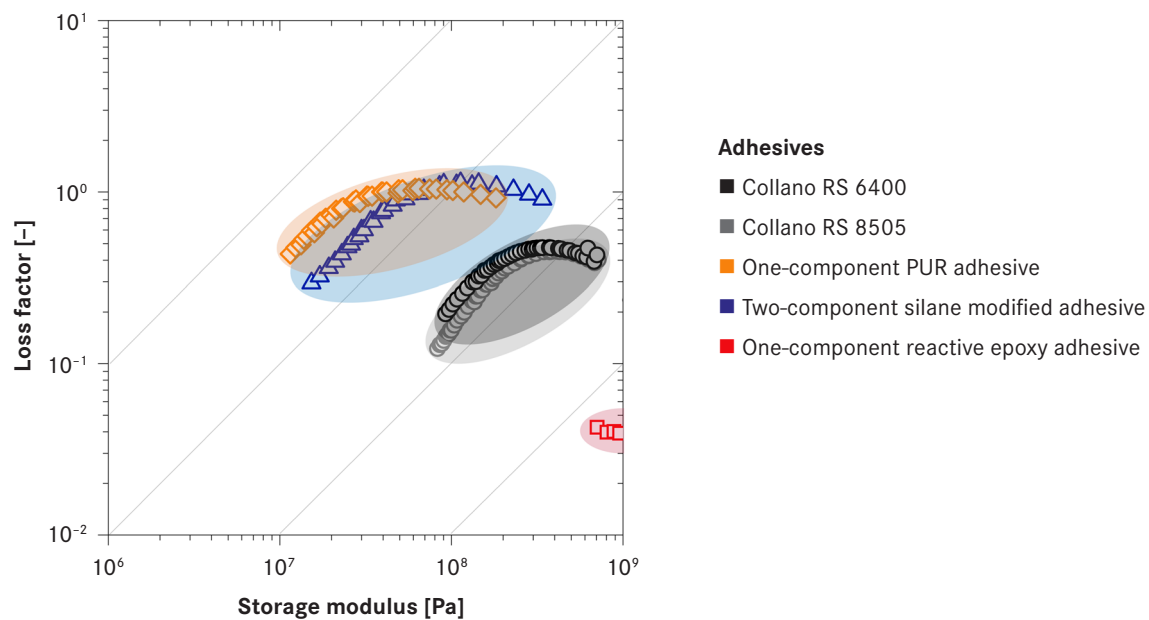


Figure 1 presents the loss factor, a measure of material damping, plotted against the storage modulus, measure of material stiffness.

Fracture performance

derived from tensile and lap-shear tests on untreated aluminium:

- In general, the plot separates adhesives by damping/flexible (upper-left) versus structural/rigid (lower-right).
- Collano RS 8505 (■) shows the highest toughness and fracture energy values, Collano RS 6400 (■) and one-component PUR adhesive (■) moderate to high toughness and fracture energy, the two-component silane modified adhesive (■) has low fracture energy and very low toughness (brittleness), while the one-component reactive epoxy adhesive (■) indicates a stiff, low damping adhesive that bonds well but fails abruptly with almost no ability to deform before breaking.

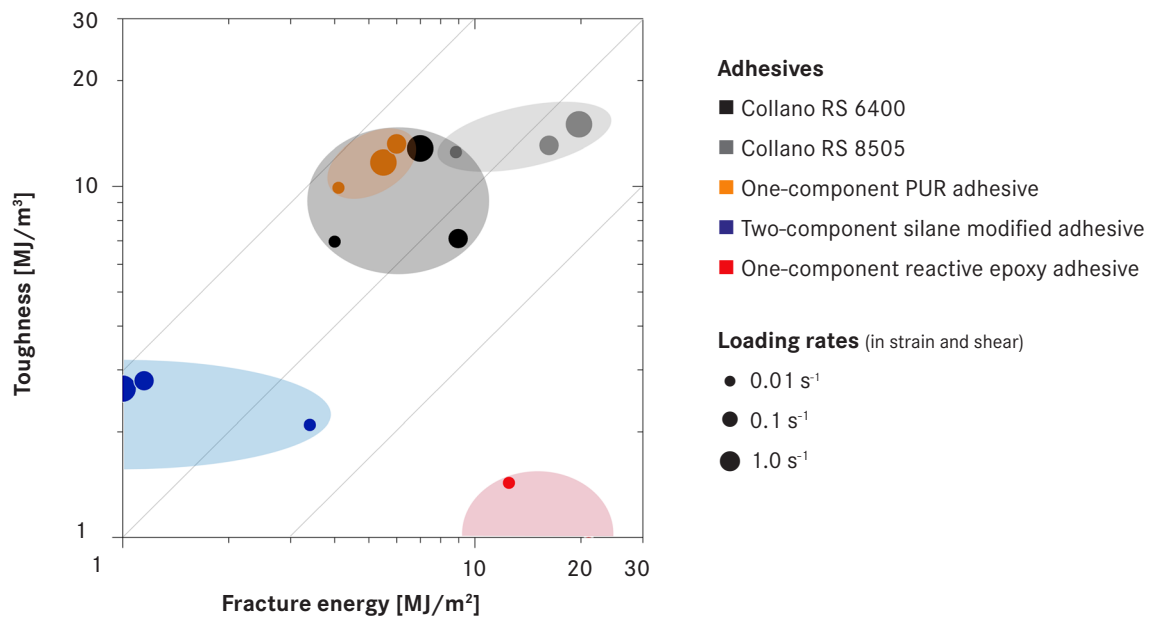


Figure 2 maps fracture performance as toughness (from tensile testing) versus fracture energy (from lap-shear testing) and shows how each adhesive balances energy absorption with resistance to crack initiation, at different loading rates (0.01, 0.1, 1.0 s⁻¹).

Shear rate performance

derived from lap-shear tests on untreated aluminium:

- The graph shows how strongly the adhesive resists shear loading and how much energy it can absorb before failure, tested at different shear deformation rates.
- **Collano RS 8505** (■) shows the material is both very strong and very tough because it stiffens and absorbs energy when hit. Here a desired cohesive fracture failure is predominantly attained.
- **One-part reactive epoxy adhesive** (■) achieves similar strength and fracture energy as RS 8505 but attains predominantly a less desired adhesive fracture failure.
- **Collano RS 6400** (■) performs consistently across different shear loading rates and falls in the mid to high performance range. It shows a 50/50 mix fracture failure, indicating that the adhesive bond is evenly shared between the surface bond and the internal strength of the material.
- **One-component PUR adhesive** (■) is too soft for lap-joint load transfer despite excellent damping.
- **Two-component silane modified adhesive** (■) exhibits poor wetting on untreated aluminium, as demonstrated by the predominantly adhesive fracture failure that was attained. This is a critical liability for the target applications.

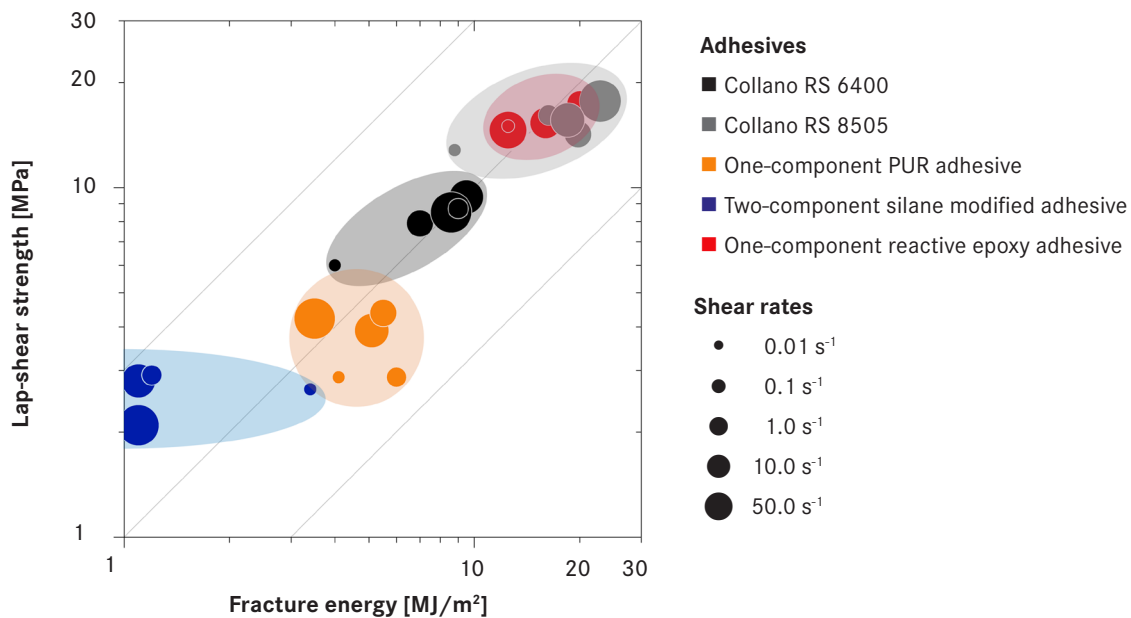


Figure 3 maps lap-shear strength versus fracture energy across shear loading rates (0.01–50 s⁻¹) separating adhesives by lap-shear performance.

Summary

Property	Comments	Collano RS 6400	Collano RS 8505	One-component PUR	Two-component silane-modified	One-component epoxy
Damping and Stiffness (DMA)	Ability to absorb vibration vs. its stiffness	Balanced: good mix of stiffness and vibration damping	Balanced: good mix of stiffness and vibration damping	Very soft: excellent damping, low stiffness	Soft: good damping low stiffness	Very stiff: almost no damping
Fracture Performance (Lap shear, increasing loading rates)	Crack resistance through increased energy absorption	Moderate-High toughness: absorbs energy reasonably well	Highest toughness: absorbs the most energy	Moderate-High toughness: flexible and energy-absorbing	Low toughness: brittle and cracks easily	Low toughness: high strength but cracks suddenly (brittle)
Shear Rate Performance (Lap shear, increasing shear rates)	Resistance to shear loads and rapid impacts	Consistent performance: stable across shear rates	Highly robust and impact-resistant	Too soft for load bearing joints, good damping	Poor performance: weak bonding to untreated aluminium	Robust but brittle: inconsistent bond performance
Overall Behaviour	Summary of general characteristics	Robust and flexible	Most robust and energy-absorbing	Soft and damping focused	Weak bonding and brittle	Very robust but brittle

Conclusion

The tested silane-epoxy adhesives Collano RS 6400 and Collano RS 8505 show a balanced and technically superior property profile in a benchmark comparison. They combine structural strength with effective vibration and shock absorption – a combination that is not achieved by the reference adhesives (PUR, silane-modified, epoxy) examined.

Collano RS 8505 delivers the highest toughness and energy absorption and demonstrates robust performance, particularly under dynamic loading, with a predominantly cohesive fracture pattern. Collano RS 6400 achieves stable medium to high values and impresses with consistent behavior across different load rates.

The results prove that both adhesives are particularly suitable for applications that require load transfer, impact resistance, and durability – especially in ballistic protection systems and demanding structural outdoor applications.

Contact

Dominik Fuhrer, Global Business Development Manager
Phone +41 41 545 98 19, dominik.fuhrer@collano.com

collano.com/applications/security ↗