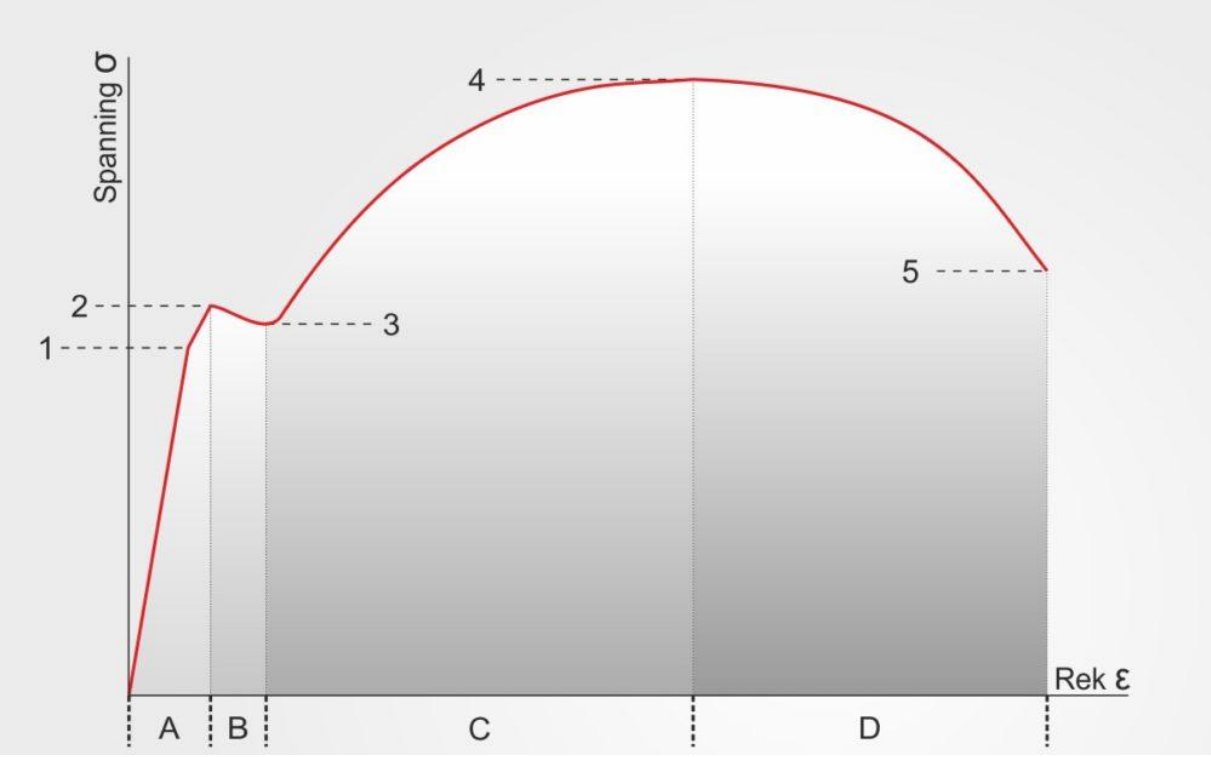
CHARACTERISTIC SHEAR RESPONSE OF STRUCTURAL ADHESIVES

In modern façade engineering, structural adhesives must do far more than simply “stick” materials together.
They must safely absorb:

- wind loads,
- thermal expansion,
- vibrations,
- dynamic movements,
- and long-term mechanical stresses

while maintaining a durable and reliable bond throughout the entire lifespan of the construction.
To understand how adhesive systems behave under these conditions, engineers analyze the **stress-strain diagram** — one of the most important tools in understanding the mechanical behavior of structural adhesives.



What Does the Stress-Strain Diagram Show?
The stress-strain diagram illustrates how an adhesive reacts when subjected to mechanical forces.

The diagram shows:

- the applied stress (vertical axis),
- versus the resulting deformation or elongation (horizontal axis).

In simple terms, it tells us: **how much an adhesive stretches under load before it permanently deforms or ultimately fails.**
This information is essential in determining whether an adhesive system is suitable for long-term structural façade applications.

Phase A — Elastic Behaviour
The first part of the stress-strain diagram represents the **elastic phase**.
During this phase:

- the adhesive stretches under applied stress,
- but fully returns to its original shape once the force is removed.

This is called: **elastic deformation.**
At this stage, the deformation is proportional to the applied force:

- More stress creates proportionally more elongation.

This behavior is known as:
linear elastic deformation.
The limit of this proportional behavior is called the: **proportionality limit (Point 1)**

Beyond Linear Elasticity
After the proportionality limit, the adhesive still behaves elastically, but no longer in a perfectly linear manner.
This means:

- deformation increases faster than the increase in stress,
- while the adhesive still returns to its original shape when unloaded.

This stage is called:
non-linear elastic deformation.
The maximum point at which the material can still recover completely is known as the:
elastic limit (Point 2)
Below this point, the adhesive maintains full recovery capability.

Phase B — Yielding Begins
Once the adhesive exceeds the elastic limit, it enters the: **yield phase (Point 3)**
At this stage:

- permanent deformation begins,
- and the adhesive no longer fully returns to its original dimensions.

This is known as: **plastic deformation.**
The material starts to “flow” internally under stress.

Phase C — Reinforcement and Maximum Strength
As the load continues to increase, the adhesive enters a reinforcement phase.
During this stage:

- the adhesive can still absorb increasing stress,
- while undergoing controlled deformation.

Eventually, the adhesive reaches its: **maximum stress or ultimate strength (Point 4)**
This is the highest stress level the adhesive can withstand before localized weakening begins.

Final Failure — Rupture Strength
After reaching maximum strength, the adhesive begins to locally thin or constrict until final rupture occurs.
This final breaking point is called: **rupture strength or breaking stress (Point 5)**
At this point:

- the adhesive bond ultimately collapses,
- and complete failure occurs.

Understanding this entire stress-strain behavior is essential for designing safe and durable bonded façade systems.

Why This Matters in Façade Bonding
Modern façade constructions are continuously exposed to:

- wind pressure and suction,
- thermal expansion,
- building movement,
- vibrations,
- and environmental ageing.

Structural adhesives must therefore combine:

- elasticity,
- strength,
- flexibility,
- and fatigue resistance.

A properly engineered adhesive system distributes stress evenly and prevents dangerous stress concentrations that could otherwise lead to premature failure.
This is exactly why advanced adhesive systems such as TWEHA® products are developed and tested extensively under real-world conditions.

Engineering Confidence Through Proven Technology
At TWEHA®, adhesive performance is not based on assumptions.
It is based on:

- mechanical engineering principles,
- extensive laboratory testing,
- decades of field experience,
- and millions of square meters of successful façade applications worldwide.

Because true structural reliability starts with understanding exactly how an adhesive performs under stress.

TWEHA®, 2026