SURFACE TENSION

The Key to Reliable Adhesion in Bonded Façade Systems
In bonded façade constructions, achieving durable and reliable adhesion depends on far more than simply selecting a high-quality adhesive. One of the most critical factors in successful bonding is the **surface tension of the substrate**.
At TWEHA®, understanding surface tension is an essential part of developing safe and high-performance façade bonding systems.

What Is Surface Tension?
Surface tension is a physical property caused by the attraction between molecules at the surface of a material. Because these molecules strongly attract one another, they create a form of "molecular tension" at the surface.
This molecular attraction keeps the surface tightly closed and resistant to penetration unless the adhesive can properly spread and interact with it.
This spreading behavior is called: **Wetting**
Good wetting means the adhesive flows evenly across the substrate surface, allowing optimal chemical interaction and strong adhesion.
Without proper wetting, durable bonding simply cannot be achieved.

A Simple Example: Water on Glass vs Plastic
Surface tension can easily be illustrated using a simple drop of water.
When a drop of water is placed on very clean glass, the water spreads out almost completely. This happens because glass has a relatively high surface tension and high surface energy.
By contrast, when the same drop is placed on certain plastics with very low surface tension, the water remains as a bead on the surface and does not spread.
This immediately demonstrates how difficult adhesion becomes on low-energy surfaces.

Surface Preparation Is Critical
Some façade materials naturally have low surface tension. In addition, many façade panels are treated during manufacturing with processing aids such as:

- Mold release agents
- Surface protection additives
- Protective foil treatments

These substances are often applied to help panels release from molds or to facilitate easy removal of protective films.
However, these treatments also reduce the chemical activity of the surface, significantly lowering adhesion performance.
Before bonding, these contaminants and surface treatments must therefore be properly removed.

The Relationship Between Adhesive and Surface Energy

Reliable bonding is achieved when:
The surface tension of the adhesive is lower than the surface tension of the substrate.
This allows the adhesive to properly wet and chemically interact with the surface.
TWEHA® bonding systems are based on advanced **Silane Modified Polymer (SMP)** technology. These adhesives are polar in nature and therefore possess relatively high surface energy themselves.
As a result, TWEHA® adhesives achieve excellent adhesion on polar substrates with high surface energy, such as:

- Glass
- Aluminum
- Steel
- Metal surfaces
- Many mineral-based materials

Challenges with Low Surface Tension Materials

The most critical bonding challenges occur on so-called **a-polar substrates** — materials with low or very low surface tension.
These include many plastics and polymer-based materials such as:

- Polyethylene (PE)
- Polypropylene (PP)
- Silicone surfaces
- PTFE (Teflon™)

Because these materials naturally resist wetting, achieving reliable long-term adhesion can be extremely difficult without proper surface preparation or specialized bonding technology. This explains why many conventional adhesives fail on low-energy substrates.

A Simple Surface Tension Test

The surface tension of a substrate can often be checked quickly and easily using demineralized water.

- **High Surface Tension**
  If the water drop spreads across the surface, the substrate has relatively high surface tension and is generally easier to bond.
- **Low Surface Tension**
  If the water remains as a bead or droplet on the surface, the substrate has low surface tension and may require special preparation or treatment.
  This simple test already provides valuable insight into the expected bonding behavior of the material.

Tested and Approved by TWEHA®

At TWEHA®, substrate compatibility is never left to be assumption.
Our laboratories and façade specialists extensively test and approve materials specifically for:

- Surface tension behavior
- Adhesion performance
- Long-term durability
- Chemical compatibility
- Façade application suitability

Unless otherwise indicated, bonding with TWEHA® bonding systems is permitted without additional modification or surface treatment on approved substrates.
This gives façade professionals maximum confidence in the long-term reliability of the bonded façade system.

Reliable Bonding Starts with Understanding the Surface

Successful façade bonding is not only about the adhesive itself — it is about the interaction between adhesive and substrate at a molecular level.
By combining advanced polymer technology, extensive substrate testing, and practical façade expertise, TWEHA® delivers bonding systems engineered for maximum adhesion, durability, and long-term façade safety.
Would you like advice on substrate compatibility, surface preparation, or approved bonding solutions for your façade project?
Our specialists are ready to help you achieve safe, durable, and high-performance bonding results.