Technical Bulletin

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ACHIEVING PROPER SURFACE PROFILE FOR COATING SMOOTH CONCRETE

Successful coating performance over concrete and masonry substrates depends heavily on proper surface preparation. Many coating failures can be traced back to insufficient surface profiling, contamination, or unresolved substrate defects rather than issues with the coating itself.

Smooth, steel-troweled, or hard-troweled concrete surfaces often lack the surface texture necessary to promote mechanical adhesion. When coatings are applied over surfaces that are too smooth or contaminated, the coating may not properly anchor to the substrate. The result can be poor adhesion, blistering, peeling, or premature coating failure.

Achieving the correct Concrete Surface Profile (CSP), controlling moisture, and addressing common substrate issues such as laitance, bond breakers, and spalling are critical steps prior to coating application. Proper preparation allows the coating to mechanically bond to sound concrete and helps ensure long-term system performance.

Understanding Concrete Surface Profile (CSP)

The International Concrete Repair Institute (ICRI) developed CSP standards to classify concrete surface roughness (Figure 1). The scale ranges from CSP 1 (very smooth) to CSP 10 (very rough) and provides a visual reference for determining whether a prepared surface is suitable for a particular coating system.

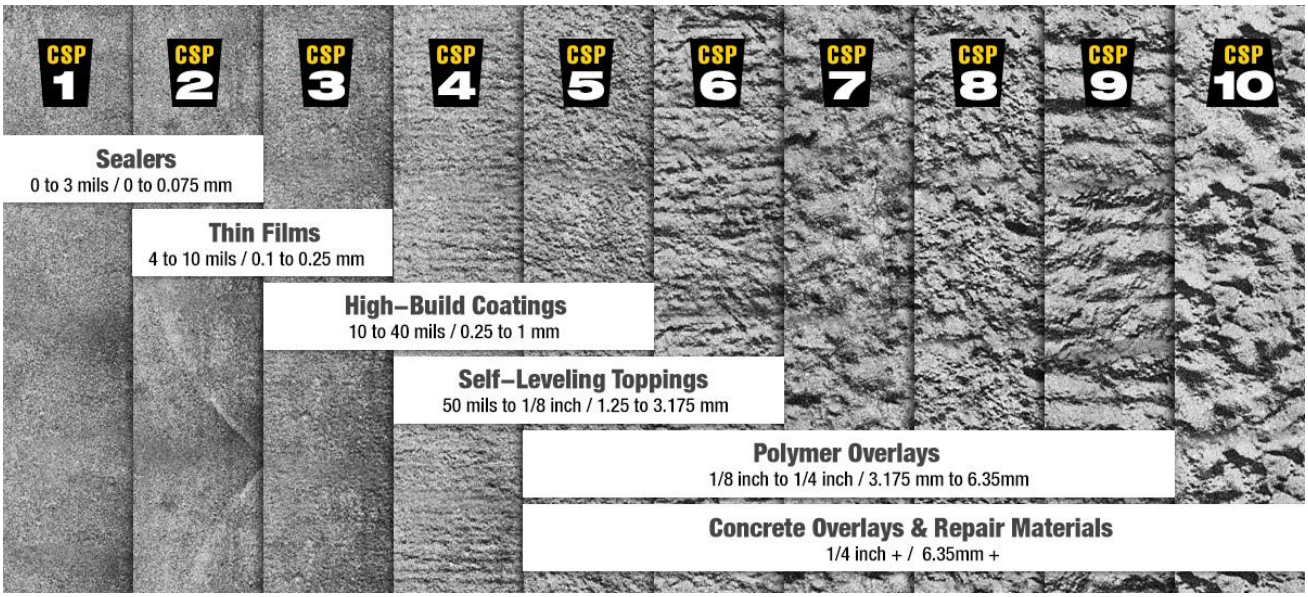

Figure 1

Different coating systems require different levels of surface roughness:

- Thin-film coatings such as acrylics, stains, and thin epoxy sealers typically require CSP 1–3.
- Medium-build coatings, including many water-based or solvent-based epoxies and urethanes, generally require CSP 3–5.
- High-build coatings, self-leveling systems, or thicker resurfacing materials may require CSP 4–6 or greater, depending on system thickness and manufacturer recommendations.

The objective is to create enough surface texture for the coating to mechanically anchor into the concrete without over-profiling the surface.

Mechanical Surface Preparation Methods

Smooth or steel-troweled concrete typically requires mechanical preparation to achieve the appropriate CSP. Common preparation methods include grinding, shot blasting, scarifying, and abrasive blasting.

Shot blasting is often preferred for coating preparation because it produces a uniform, consistent surface profile while removing weak surface layers and contaminants.

Grinding can be suitable for achieving lighter profiles but must be performed thoroughly. Incomplete grinding may leave polished areas that appear prepared but remain too smooth for proper coating adhesion.

The selected preparation method should always align with the coating manufacturer's recommended CSP range.

Removing Laitance

One of the most common issues affecting smooth concrete is laitance. Laitance is a weak, chalky layer of cement fines and water that rises to the surface during concrete placement and finishing. Because this layer has very low cohesive strength, it can act as a bond breaker if coatings are applied over it.

Mechanical surface preparation must remove laitance completely and expose sound, structurally intact concrete capable of supporting the coating system.

Figure 2c

Bond Breakers and Curing Compounds

Construction processes often introduce materials that intentionally prevent adhesion. These can include curing compounds, form-release agents, and bond breakers used in tilt-up construction.

These materials can significantly interfere with coating adhesion if they remain on the surface. Mechanical profiling methods such as shot blasting or abrasive preparation are typically required to remove these contaminants and expose clean concrete.

Addressing Spalling and Surface Defects

Concrete surfaces should also be inspected for physical damage prior to coating. Common defects include spalling, cracking, scaling, and surface deterioration.

Spalling occurs when concrete chips or flakes away due to corrosion of reinforcing steel, freeze–thaw cycles, or impact damage. Coatings applied over unsound or delaminated concrete will fail regardless of surface profile.

All deteriorated areas must be repaired using compatible patching or resurfacing materials before the coating system is installed.

Figure 3

Moisture Evaluation

Moisture control is another critical factor when coating concrete. Concrete is a porous material capable of retaining significant moisture long after placement. Excess moisture vapor transmission can lead to blistering, adhesion failure, or coating delamination.

For high-performance systems, in-situ RH testing may be required. Moisture levels must always comply with the coating manufacturer’s specifications before application.

Limitations of Acid Etching

Historically, acid etching was used to create surface texture on smooth concrete by chemically reacting with cement paste. While this process can open the surface to some degree, it has several limitations.

Acid etching may not consistently produce the uniform, measurable CSP required for modern coating systems. It also introduces additional water into the concrete, which can increase moisture levels and extend drying time. Improper neutralization or residual acid can further interfere with coating adhesion.

For these reasons, mechanical surface preparation is generally preferred over acid etching when preparing concrete for coatings.

Surface Cleanliness and Environmental Conditions

In addition to achieving the correct surface profile, the substrate must be clean and free of contaminants such as dust, grease, oil, salts, and construction debris.

After mechanical preparation, all dust and residue should be removed using industrial vacuuming or other appropriate cleaning methods.

Environmental conditions should also be monitored. Surface temperature should meet the coating manufacturer’s minimum requirement and typically remain at least 5°F above the dew point to prevent condensation during application.

Areas where moisture may migrate from below the slab, particularly where vapor barriers are absent, should also be evaluated prior to coating installation.

Key Takeaways

Achieving the correct surface profile is one of the most important steps when coating smooth concrete. Proper preparation ensures that the coating can mechanically bond to the substrate and perform as intended.

Matching the appropriate CSP level to the coating system, removing laitance and bond-breaking contaminants, repairing substrate defects, and verifying acceptable moisture levels all contribute to successful coating performance.

Mechanical surface preparation methods typically provide the most consistent and reliable results. When these preparation steps are properly executed, they create the foundation for durable adhesion and long-term coating performance on concrete and masonry substrates.

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