CORIAN® EXTERIOR CLADDING

The design and technology of today's high performance curtain wall systems must accommodate a complex interface of materials and design and meet some of the most demanding requirements of any building system. The modern curtain wall is comprised of construction elements that provide structural support, weather resistance and the overall architectural design expression of the building.

Different curtain wall systems include engineered masonry and precast "stick frame" and "unitized" curtain walls in addition to a number of different structural steel and light-gauge metal panelized systems. Exterior wall systems that are ideally suited for DuPont™ Corian® Exterior Cladding (EC) utilize a continuous backup structure and are engineered and fabricated in large panel configurations. Connections can be mechanically attached or adhered, but must be engineered with sufficient tolerances and flexibility to allow for all differential movements.

Corian® EC offers advantages in panelized wall systems that include:

- **Structural Performance**
  - lightweight for reduced structural load and ease of installation
  - flexural and tensile strength offer excellent resistance to wind loads
  - compatible with typical building materials, structural silicone and sealants.
- **Fire Performance**
  - Class 1 (A) fire rated according to ASTM E84.
- **Weatherability**
  - low moisture absorption and coefficient of expansion
  - weather resistance in conditions of wind-driven rain (fewer joints, ability to form joints)
  - weather resistance to extreme freeze-thaw conditions
  - resistant to chemicals, detergents and environmental pollutants
- **Fabrication and Installation**
  - ease of fabrication -- tight manufacturing tolerances for engineered panels made of Corian® EC simplify factory fabrication
  - ease of field fabrication and modifications -- simple machining methods facilitate easy field modification as well
  - lightweight and easier to install than conventional curtain wall
  - high level of quality control available from DuPont, DuPont-certified fabricators and the panelizer/unitizer system manufacturers
- **Maintenance**
  - resistant to abuse from a broad range of paints, coatings and chemicals
  - ease of maintenance – cleaning, graffiti removal, repair and replacement
  - renewability – can be restored to its original appearance mainly through cleaning and sanding if necessary

PERFORMANCE PROPERTIES OF CORIAN®

Property	Typical Result	Test
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5 x 10^6 psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2 x 10^6 psi	ASTM D 790
Hardness	>85	Rockwell "M" Scale ASTM D 785
	56	Barcol Impressor ASTM D 2583
Thermal Expansion	3.02 x 10^{-5} in./in./°C (1.80 x 10^{-5} in./in./°F)	ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance (Xenon Arc)	No effect	NEMA LD 3-2000 Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 & Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G 21 & G 22
Boiling Water Resistance	No visible change	NEMA LD 3-2000 Method 3.5
High Temperature Resistance	No change	NEMA LD 3-2000 Method 3.6
Izod Impact (Notched Specimen)	0.28 ft.-lbs./in. of notch	ASTM D 256 (Method A)
Ball Impact Resistance: Sheets	No fracture—1/2 lb. ball: 1/4" slab—36" drop 1/2"† slab—144" drop	NEMA LD 3-2000 Method 3.8
Weatherability	E^*_{94}<5 in 1,000 hrs.	ASTM G 155
Specific Gravity†	1.7	
Water Absorption	Long-term 0.4% (3/4") 0.6% (1/2"†) 0.8% (1/4")	ASTM D 570
Toxicity	99 (solid colors) 66 (patterned colors)	Pittsburgh Protocol Test ("LC_{50}" Test)
Flammability	All colors (Class I and Class A)	ASTM E 84, NFPA 255 & UL 723
Flame Spread Index	<25	
Smoke Developed Index	<25	

†Approximate weight per square foot 1/4" (6 mm) 2.2 lbs. • 1/2"† (12.3 mm) 4.4 lbs.

Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories.

NEMA results based on the NEMA LD 3-2000

WEATHERABILITY AND EXTERIOR USE OF CORIAN®

This guideline has been developed as an overview of potential performance considerations when deciding if Corian® is appropriate for an exterior application.

Color stability is often the primary concern when evaluating a material for outdoor use, but there are other performance factors that should also be considered. Many colors of Corian® exhibit good color stability, but its low moisture absorption and its resistance to stains, environmental pollutants, detergents, humidity and freeze-thaw conditions also contribute to making Corian® an excellent choice for outdoor applications. In addition, Corian® offers inconspicuous seams and can be easily sanded and/or cleaned to restore its original appearance. Even graffiti can be removed through standard pressure washing with baking soda-based cleaning agents. All of these factors combined can make Corian® a preferred material for outdoor applications. To reinforce this point, Corian® has been tested according to the following different industry standards that are used to help determine a product's suitability for outdoor use:

ASTM B117-97 Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM G85-98 Standard Practice for Modified Salt Spray Testing, Annex A4 Salt/SO_2 Spray Testing

ASTM C666-92 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

ASTM C756 Cleanability of Surface Finishes, Graffiti Resistance

ASTM D1308-93 Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes (alkali/lime and acid/acid rain resistances)

ASTM D2247-94 Standard for Testing Water Resistance of Coatings in 100% Relative Humidity

ASTM D2248-93 Standard Practice for Detergent Resistance of Organic Finishes

ASTM D570-95 Standard Test Method for Water Absorption of Plastics

ASTM G21-96 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

AAMA 605.2-9 Voluntary Specification for High-Performance Organic Coatings on Architectural Aluminum Extrusions and Panels (acid rain and mortar resistances)

ANSI Z124.6.5.2 and Z124.6.5.5 Standards for Plastic Lavatories and Sinks, Stain- and Chemical-Resistance Tests

DuPont has performed extensive color-stability testing on Corian® following ASTM and other industry standards. Development of the "Corian® Color Recommendations" is based primarily on testing according to ASTM G155 (covers ASTM G26) Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials. This test artificially accelerates and reproduces weathering effects that occur from exposure to sunlight (direct or through window glass) and rain or dew using 1,000 hours of exposure to a xenon arc lamp and water. Color changes are instrumentally measured before and after the exposure period.

Many materials fade or discolor with time due to weathering, but in many cases the natural patina that develops may be acceptable or even desirable (e.g., copper roofing). Individual Corian® colors change differently and most often exhibit changes in gloss and whitening which can be renewed with cleaning and/or sanding. The changes are more evident in saturated, chromatic and dark colors and least evident in whites, lights and many of the earth tones. Ultimately, it is up to the end user to determine if these characteristics are acceptable in the application.

Results of Corian® Recommendations

The following are DuPont's recommendations based on the above mentioned ASTM tests:

Corian® solid surfaces are grouped into Category A based on color stability:

Group A – Good; these colors are expected to meet architectural guidelines for color change of 5 units in 10 years

Exterior Corian® Color Recommendations

GROUP A

Glacier White*, Everest, Venaro White, Cameo White, Bisque, Vanilla, Bone, Festival, Tumbled Glass, Aurora, Mojave, Natural Pearl, Beach, Kilimanjaro, Pepper Ivory, Sandstone, Eclipse, Matterhorn, Primrose, Sahara, Rosetta, Sunset, Pyrenees, Prairie, Aqua, Blue Ridge, Turkish Blue, Dusk, Platinum, Mont Blanc

* The BEST choice

Surface Texture

There are numerous different surface treatments that can be applied to DuPont™ Corian® EC, including machining (sanding, routing, sandblasting, waterjet, etc.), texturing (thermal molds and presses) and layering (laminating). Different techniques can be used for surface finishing, partial surface cutting or full cutting for different shape, patterns or inlays.

Surface machining of DuPont™ Corian® EC is typically done with high-speed routing tools to create desired shapes, and with sanding or polishing tools for different finishes (semi-gloss, matte or rough-textured). High-speed routers can achieve a fine level of detail for surface cutting, and can also be driven by CNC controls to achieve intricate patterns and textures. Since DuPont™ Corian® EC is relatively easy to cut and finish, without the need for specialized diamond abrasives and saws, fabrication can be done quickly and with a high level of quality.

Surface molding and forming of DuPont™ Corian® EC is typically done with medium-temperature ovens (e.g., 350°F) and pressure molds. Geometric patterns or natural patterns can be molded into the surface to achieve a number of different architectural finishes.

Laminating multiple layers of DuPont™ Corian® EC can be done with flat and thermoformed pieces. Sections can be built up for more three-dimensional forms and patterns, and with different color combinations.

Shape

DuPont™ Corian® EC can be fabricated into a variety of shapes by different forming, shaping and machining techniques to create unique designs and finishes. When heated to 300°F (150°C), DuPont™ Corian® EC can easily be formed into various shapes. Sheets of ½" thickness can be formed to a 3" radium.

Procedures for the fabrication of DuPont™ Corian® EC have been developed from over 30 years of experience with the material, in many different forms and applications. Fabrication methods are described in the DuPont™ Corian® "Fabrication Manual."

Translucency

DuPont™ Corian® EC allows some diffuse light transmission, depending upon color and aggregate. Solid light colors such as white and beige are the most translucent, and dark colors with large aggregates are the least translucent. DuPont™ Corian® EC can be fabricated to achieve different levels of light transmission by back-cutting the material to a specified thickness. As the material is cut thinner, it allows more light through.

Architectural Components

DuPont™ Corian® EC can be fabricated for a number of different architectural applications such as column covers, soffits and fascia, and a variety of exterior details. One great advantage is that complex shapes can be formed from DuPont™ Corian® EC to avoid the weight and cost of conventional materials. In addition, coping, cap pieces, corner returns and other areas of critical water exposure can be formed of individual sheets to minimize joints and areas of potential migration or leakage. A variety of exterior architectural components have been used in many different applications throughout the world from Beijing, China, to the United Kingdom. Initial work has begun on the development of lightweight, panelized wall systems in the United States, and there are numerous early building projects in which DuPont™ Corian® EC panels are being applied.

Some of the architectural components that can be fabricated into typical architectural forms include:

- Wall panels (flat, formed, inside corners/outside corners, laminated, finished)
- Returns (e.g., windows or soffits)
- Column covers
- Arches, doffers and vaults
- Accessory elements (bullnoses, drip courses, access panels, solar control, etc.)
- Architectural trim (cap pieces, cornices, coping, base and capitals, inserts and niches, etc.)

Each of the different components can also be combined in different panel configurations, joint treatments and attachment methods to achieve different appearances. Some of the joint treatments and attachment methods include:

Joints:

- Batten or cover strip – typically an aluminum cap with a neoprene or silicone gasket, that secures the panels on two or four sides to the building structure.
- Open – an open joint is typically used with an air cavity and “air break” to create a pressure-equalized wall system, allowing equal air pressure between the exterior and the wall cavity and facilitating “weeping” of water or moisture migration.
- Revealed – typically a sealed joint, where the sealant is behind the surface of the panels, revealing the panel edge and articulating the shadow line of the joint.
- Butt – where two panels are sealed together with a “hard” or “soft” joint that is flush but visually apparent.
- “Seamed” – where two panels are sealed together with a “hard” (methylmethacylate) joint that is flush but visually “nonconspicuous.” “Seamed” joints typically require sanding and finishing to match surface properties of adjacent panels.
- Window washing track – a larger than typical joint between panels which has a vertical track designed specifically for the up and down movement of the building window washing equipment.

Attachment methods:

- Surface-attached – face-attached with pins, bolts or anchors with sufficient opening size and gaskets to allow for thermal and building differential movements. Attachments and gaskets must accommodate deflection due to wind loads or other horizontal forces which can create rotational forces.
- Framed attachments – continuous two-sided or four-sided edge framing of panels which is anchored to building structure. Frame elements should be designed with gaskets to accommodate deflection due to wind loads, and to minimize edge stresses to the material.
- Gasket attachments – neoprene or structural silicone gaskets which are attached to curtain wall framing and the building structure.
- Adhered systems – structural silicone attachment of architectural components and panels to a relatively continuous structure substrate or backup.

The fabrication of DuPont™ Corian® EC for exterior architectural components and wall systems requires specialized equipment, as well as extensive experience and skill in the use of the material. It is highly recommended that exterior wall elements of DuPont™ Corian® EC be done only with experienced fabricators.

Exterior Wall System Testing

In addition to the material testing, mockups have been built and tested with "structurally glazed" and framed curtain wall systems, and with "panelized" wall systems. The mockups allow for the evaluation of different details, attachments and design options with DuPont Corian® EC.

In one example, panels were thermoformed and machined for different surface textures and appearances. Edges were built up, and ribs were adhered to the back for structural rigidity. In another example, architectural components for column covers, spandrel sections and trim elements were formed in a large prefabricated panel system.

In addition, exterior wall system tests were performed by Construction Research Laboratory in Miami, Florida, on large curtain wall panels (over 22ft. wide and over 10 ft. high) in a four-sided "structurally glazed" configuration to evaluate:

- Static air infiltration (ASTM E283)
- Water infiltration (static pressure ASTM E331, and dynamic pressure AAMA 501.1)
- Structural deflection (ASTM E330)
- And overall system performance

The results of the test were very good, with negligible air leakage, no water leakage by static or dynamic pressure tests, and no structural damage or failure for tests carried out to positive pressures of +90 psf and negative pressures of –120psf (155 mph wind).

Additional Information

For more information please contact Frank Yan, (302) 999-2605.

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