High Performance Coatings for Industrial and Decorative Floors

COV001
Learning Units: 1.0 LU/HSW

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Learning objectives

Upon completing this program, the participant should be able to:

1. Understand the history and basic science behind modern polyurethane and polyurea floor coatings
2. Name several sustainability market drivers and aesthetic preferences for floor coatings and how they fit in green building standards
3. Understand the surface preparation, safe use and handling requirements for a professional application of these coatings
4. Be familiar with floor coating case study examples from real world projects that retasked or adapted existing concrete floor space and the reasons for their selection

Agenda

- The History and Science Behind High Performance Coatings
- Sustainability Market Drivers
- Surface Preparation and Safe Use Considerations
- Case Histories: Industrial and Decorative Flooring
- Summary and Comment

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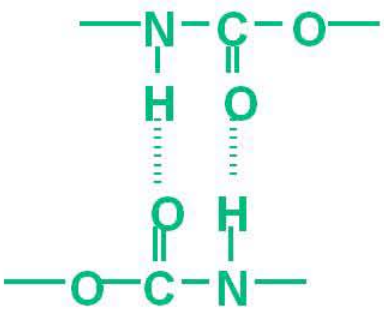
High performance coatings have their roots in pre-WWII developments

Timeline of Technologies - Past to Present

1930s	**Urethanes developed by Otto Bayer**
1940s	**First use of Aromatic hardeners in coatings**
1960s	**Development of Aliphatic hardeners for coatings**
1970s	**Waterborne PolyUrethane Dispersions (PUDs) introduced**
1970s	**Two Component (2K) Solventborne polyurethane coatings**
1970s	**2K solvent free Aromatic coatings**
1980s	**2K Polyaspartic and 1st generation 2K Waterborne coatings**
2000s	**2K Waterborne polyurethane coatings**
2000s	**Waterborne UV curable coatings**

There are two fundamental reasons these coatings have excellent properties

Hydrogen Bonding



- Acts as a crosslink site – like ropes and magnets
- Allows for thermoplastic flow to relieve stress
- Extraordinary hardness and flexibility

and

Crosslinking

- Entanglement of polymer chains – like a screen in a window
- Increases physical strength and chemical resistance
- Network of bonds

We'll be covering several technologies in this course

Polyaspartic Coatings: Low to VOC-free two component (2K) aliphatic polyurea coating, fast cure, light/weather stable

One and Two Component Waterborne Coatings: Ultra low VOC polyurethane or polyacrylate coating, low odor, medium to long open time, light/weather stable

Waterborne UV Curable Coatings: Ultra low VOC one component UV polyurethane clearcoats, low odor, fast to very fast cure

All three technologies contain no added phthalate, formaldehyde or heavy metals

Basic Chemistry and Properties

Polyaspartic Coatings

Polyaspartics are high build, fast curing floor coatings with excellent clarity, longevity, and 'color pop'

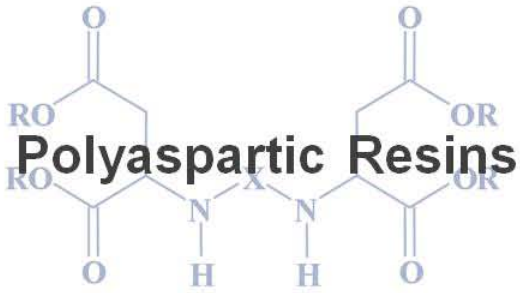
'Paint on Steroids'

- Many floor coatings are less than 4 mils thick, polyaspartic can be >15 mils
- The saying, "Like watching paint dry" means more labor time
- Polyaspartic technology allows for one coat, high build finishes
- Cure times are greatly improved and allow for faster return-to-service times which reduces labor costs

Polyaspartic Coatings are a two component, crosslinked technology

Chemistry:

2K aliphatic polyurea based on polyaspartic resins and an aliphatic hardener



Polyaspartic Resins

Aliphatic Hardener

React to form

A Polyaspartic Coating

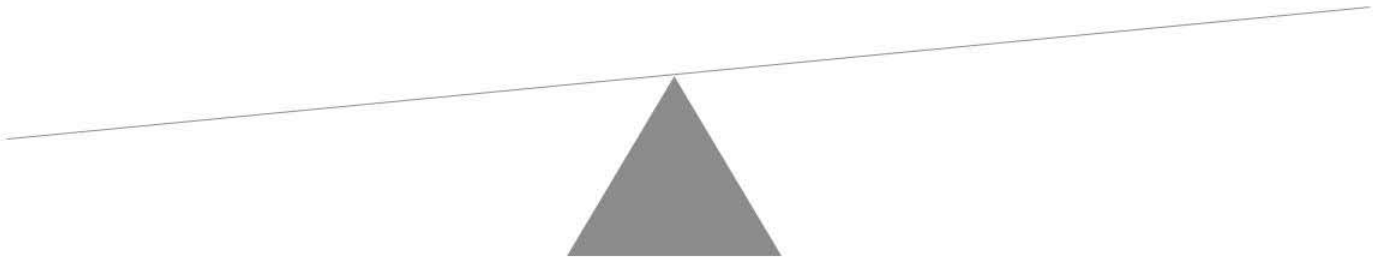
Polyaspartics exhibit balanced general traits regardless of the manufacturer

Benefits:

- Excellent durability
- Excellent color stability
- Fast return-to-service
- High build per coat
- Labor savings
- Ultra-low VOC
- Low temperature cure

Drawbacks:

- Cure time affected by humidity
- Difficult to downgloss/matte
- Two component – requires mixing



Basic Chemistry and Properties

1K and 2K Waterborne Coatings

Waterborne one and two component coatings have very good to excellent overall properties

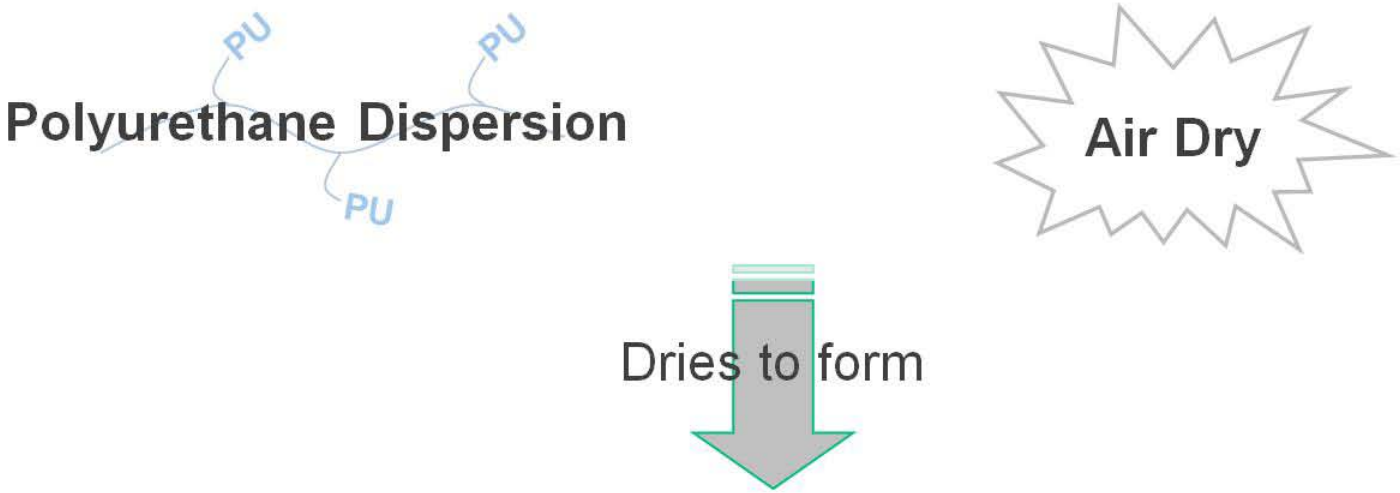
'Water is Green'

- Early "waterborne" coatings had up to 300g/l of co-solvent
- New second generation commercial systems are now at 0-15 g/L
- Offer viable replacement products to solventborne systems
- Achieves high chemical resistance in a waterborne product

One component (1K) waterborne coatings simply dry to a finished film

Chemistry:

1K Aliphatic polyurethane coating based on a polyurethane dispersion



1K waterborne coatings enable specifiers to hit a specific price-performance target

Benefits:

Very good durability

Good color/gloss retention

Easy to Use – One component

Lower VOC (typically 50 - 100 g/L)

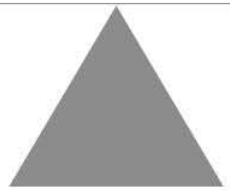
Low odor

Drawbacks:

Cold weather/high humidity lengthens cure time

May need clear primer for poorly prepared concrete

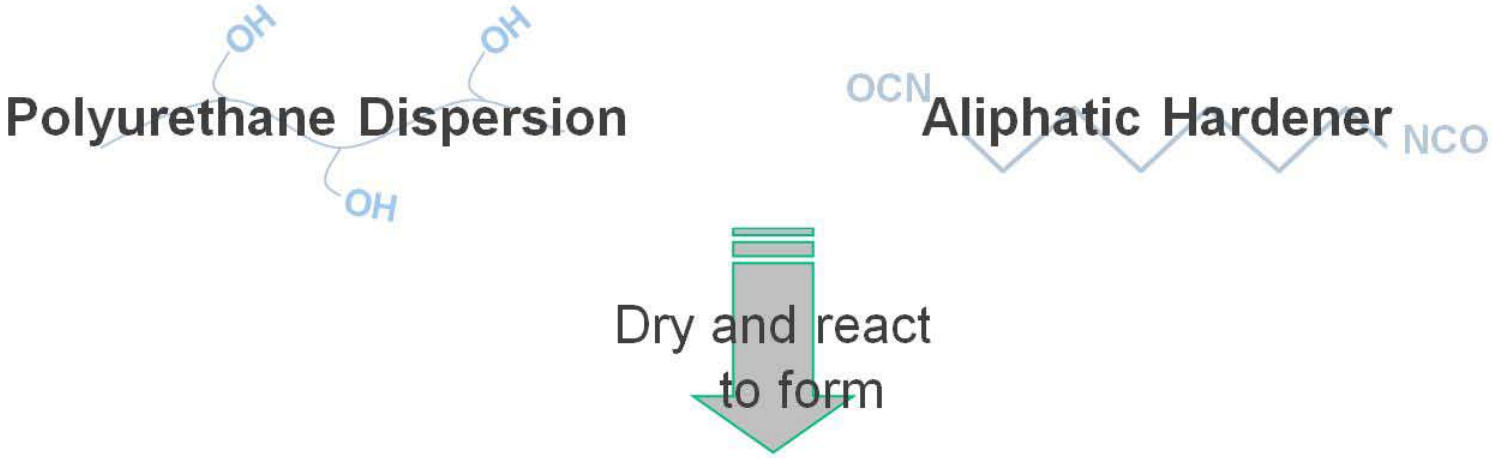
May stain due to vehicle hot tire exposure



Two component (2K) waterborne coatings cure by both drying and reacting

Chemistry:

2K aliphatic polyurethane based on polyurethane or polyacrylate dispersions and aliphatic hardeners



2K waterborne coatings have desirable traits and an excellent price-performance ratio

Benefits:

Excellent durability

Excellent color/gloss retention

Gloss to matte finish available

Long working time

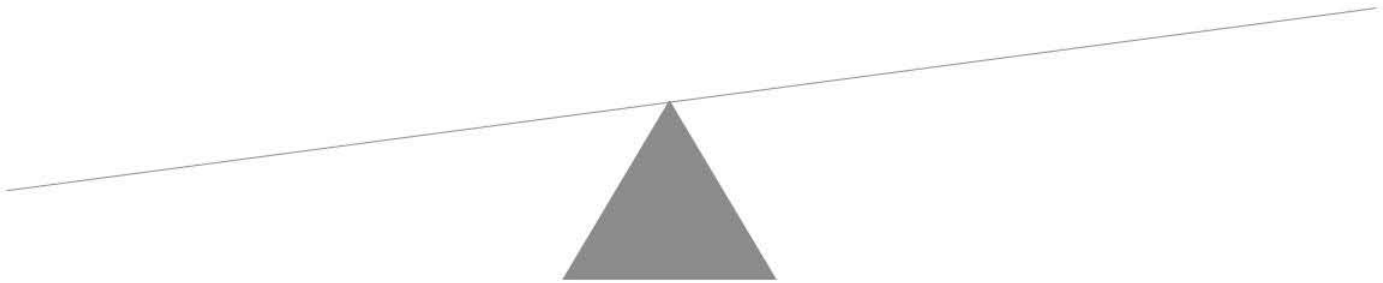
Ultra low VOC (<15g/L)

Very low odor

Drawbacks:

Cold weather/high humidity lengthens cure time

Two component – requires mixing step



Basic Chemistry and Properties

Waterborne UV Curable Coatings

UV cured coatings are fast with scratch resistance, gloss retention, and adhesion

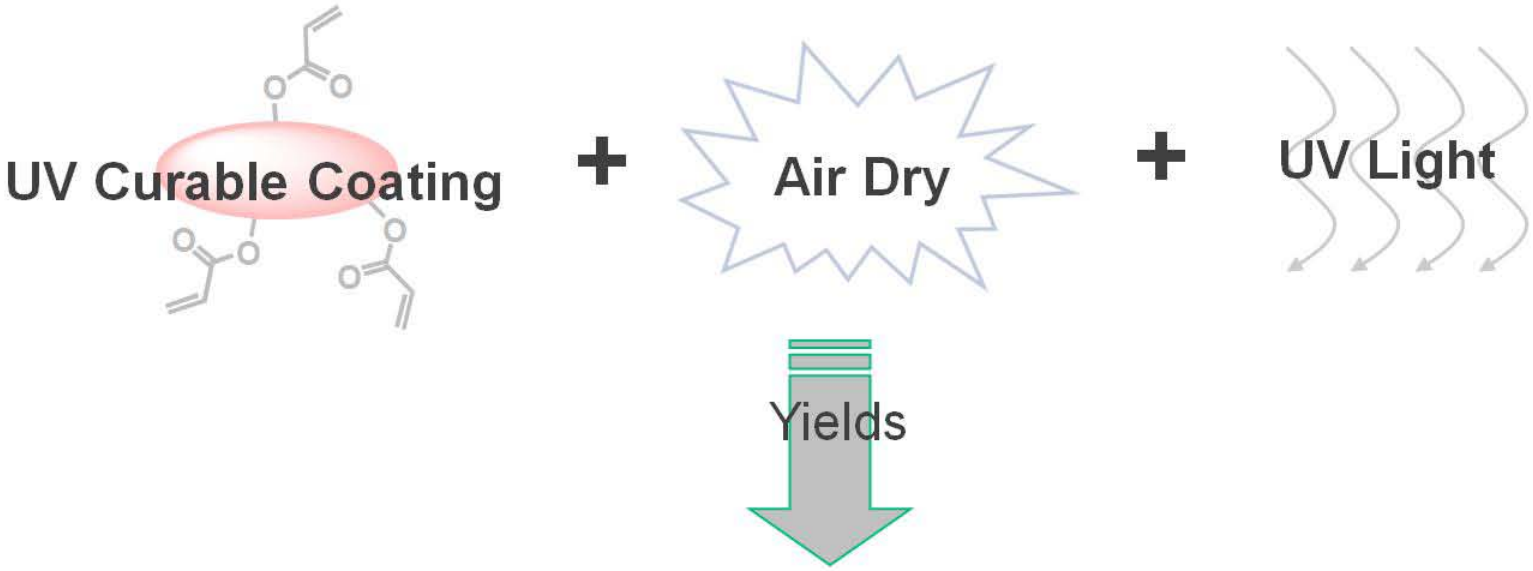
‘Cure at the Speed of Light’

- Some viable flooring opportunities go uncoated due to timing
- After drying, coating cures instantly to final properties when exposed to UV source
- On resilient floors, eliminates the stripping, waxing and burnishing process
- Can also be used for on-site applications of hardwood refurbishment

Waterborne UV curable coatings dry and then are cured with ultraviolet light

Chemistry:

1K UV curable resin with added photo initiators



Waterborne UV curable coatings are typically used where speed and labor are a factor

Benefits:

One component coating

'Instant' cure after drying

Very good stain and abrasion resistance

Ultra-low VOC

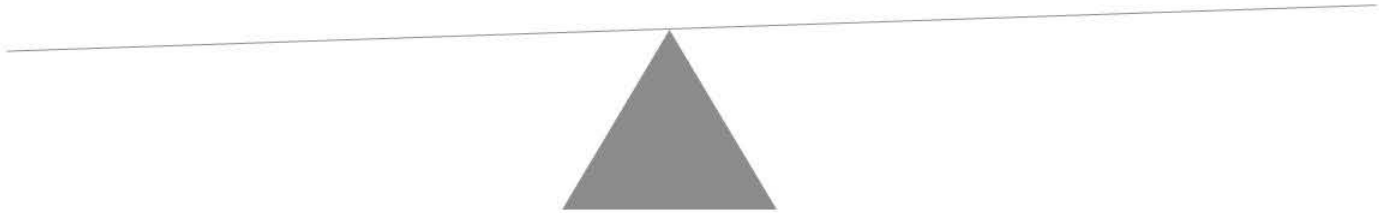
Can be applied in high traffic areas

Drawbacks:

Cold weather/high humidity lengthens dry time

Requires curing step with portable UV light equipment

May have slight odor depending on formula



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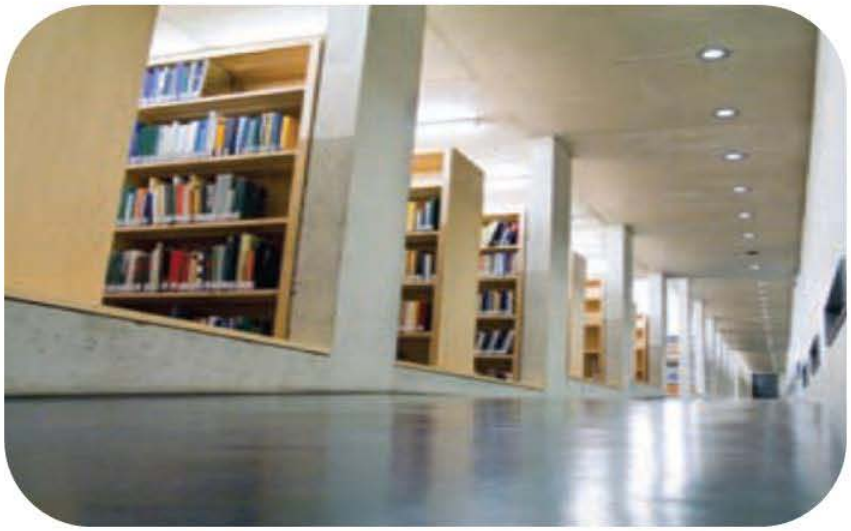
There are many sustainability drivers for concrete coatings

- VOC compliance
  - Ultra low to zero VOC options
- Environmentally preferred content
  - Preferences and trends
- Renewable materials
  - Ex. Natural oil derived resins
- Recycled content
  - Ex. Used polymer glycolysis, fillers
- Energy efficiency contributions
  - Ex. Daylighting efficiencies, UV curable
- Environmental Footprint (LCA)
  - Demonstrate sustainability, EPD
- Environmental Performance
  - New standards account for durability
- Locally Manufactured
  - Lowers carbon footprint
- End of Life (downstreaming)



There are green building targets where coating choice can contribute to LEED credits or achieving certification

LEED NC v2009 IEQc4.2 and NC v4 IEQ Options 1 and 2

- Floor coatings meeting and passing these requirements:
  - ✓ SCAQMD Rule #1113
  - ✓ CDPH Standard Method v1.1
  - ✓ Green Seal GS-11

LEED NC and EBOM IDc1 or IOc1

- High performance floor coatings can contribute to innovation in operational efficiencies by their demonstrated long term durability over concrete as well as resilient floor coverings

Your specific coating supplier will have listing information for their products

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Concrete surface preparation is the most important success factor for floor coatings

Porosity, age, laitance, and WVT are factors to consider

Cleaning concrete

- For oil and grease, do not use solvents
- Instead use detergents or steam cleaning

Surface profile

- Use grinding, shotblasting, or acid etch
- Residual dust needs removed prior to coating

Refer to **SSPC SP-13 Surface Preparation of Concrete** and **ICRI Guideline Number 310.2R** industry standards

Improper surface preparation is responsible for the majority of coating failures

Reasons for Coating Failures :

80 % Surface Prep	· Loss of adhesion (to concrete) · Delamination (to primer) · Blistering over time
15 % Application Issue	· Delamination or intercoat adhesion issues due to exceeding overcoat window · Blistering due to climate conditions, film thickness · Poor mixing causes varying physical properties
5 % Material	· Wrong material selected · Change from recommended use

There are industry standards for the safe use and handling of floor coatings

High performance floor coating systems, which can contain an isocyanate during mixing and application, can be safely used when the recommended engineering controls, PPE and handling procedures are implemented.

After cure, the coating is fully reacted and is a solid polyurethane or polyurea film.

The coating applicator will need to consider safe use and handling recommendations

Appropriate controls are determined by various factors

- Degree of hazard
- Type of application
- Duration of application

Recommendations for Handling Isocyanates

- Training of personnel
- Implementation of engineering controls (e.g., local exhaust ventilation)
- Personal protective equipment (e.g., respirators, clothing, and gloves)
- Medical surveillance
- Workplace monitoring

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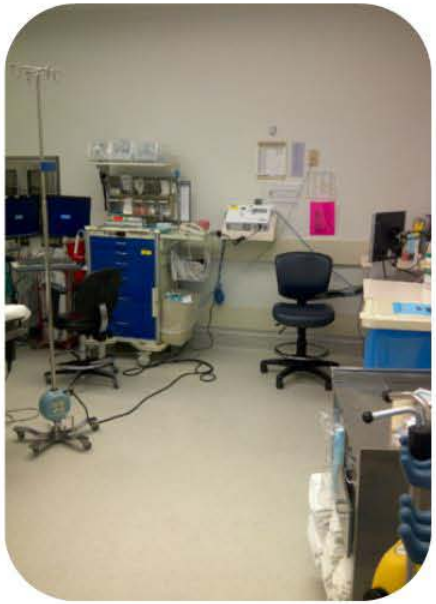
Case Histories: Industrial Flooring

Parking Decks and Garages: Fast cure means shorter return-to-service time and less revenue loss



Hangars and Warehousing: Coatings with excellent chemical and hot tire resistance

Healthcare: Resistance to constant mopping with strong disinfection chemicals such as bleach

Industrial Application – Mechanical Room

Polyaspartic coating applied to 6,000 ft² over existing 35 year old concrete for fast return-to-service and durability.

Trade School Physical Plant

Owner:

- Pittsburgh Gateways

Contractor:

- PIM Corp.

Supplier:

- The Sherwin Williams Co.

System:

- Pigmented polyaspartic basecoat with clear polyaspartic topcoat

Commercial Application – Bakery

Polyaspartic coating applied to 800 ft² in place of PVC sheet material that was disbonding. Owner wanted seamless floor.

Commercial Bakery and Market

Owner:

- Springhouse Market

Contractor:

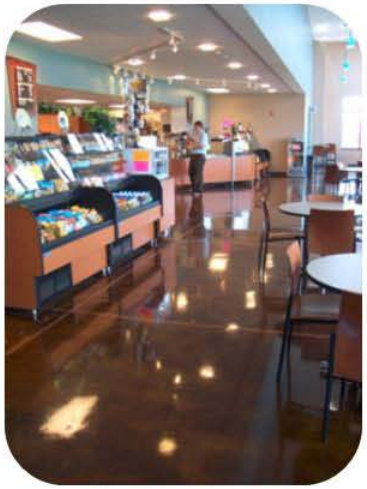
- Seman Flooring Co.

System:

- Pigmented polyaspartic basecoat, color flake chips, two clear polyaspartic topcoats

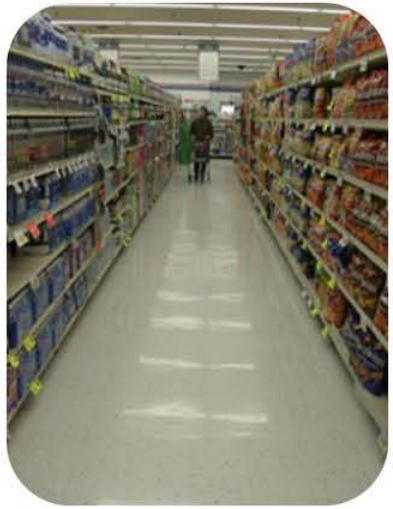
Case Histories: Decorative Flooring

Stadiums and other Venues: Durable high gloss coatings go back into service quickly and take the abuse from customers



Commercial Space: Hotels, restaurants and universities like the seamless decorative finishes and quick installation

Retail and Education: Grocery store and school personnel with vinyl floors would like to eliminate the waxing and burnishing cycle



Architectural Application
Energy Innovation Center

32,000 ft² waterborne polyurethane floor coating applied to existing 80 year old concrete chosen for LEED requirements and abrasion resistance.

Energy Innovation Center

Owner:

- Pittsburgh Gateways Corp. in conjunction with U.S. Department of Energy's National Energy Technology Laboratory

Contractor:

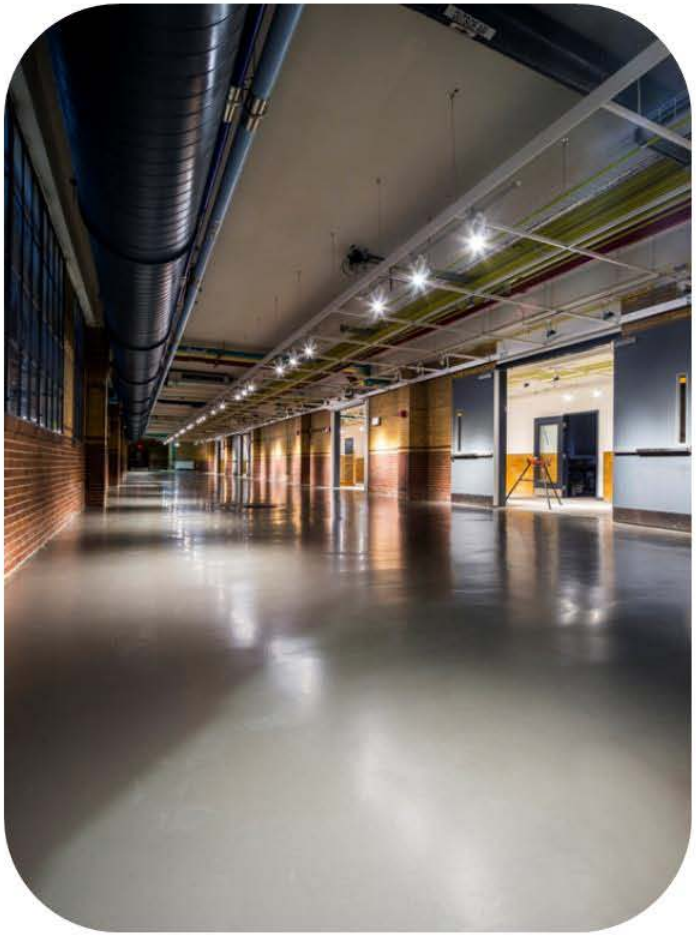
- Seman Flooring Co.

Supplier:

- The Sherwin Williams Co.

System:

- Pigmented epoxy basecoat, 2K WB clear polyurethane topcoat



Architectural Application – Disney Stadium

250,000 ft² polyaspartic concrete coating applied to exterior stadium deck for aesthetics, stain and abrasion resistance

Disney's Champion Stadium

Owner:

- Disney World

Contractor:

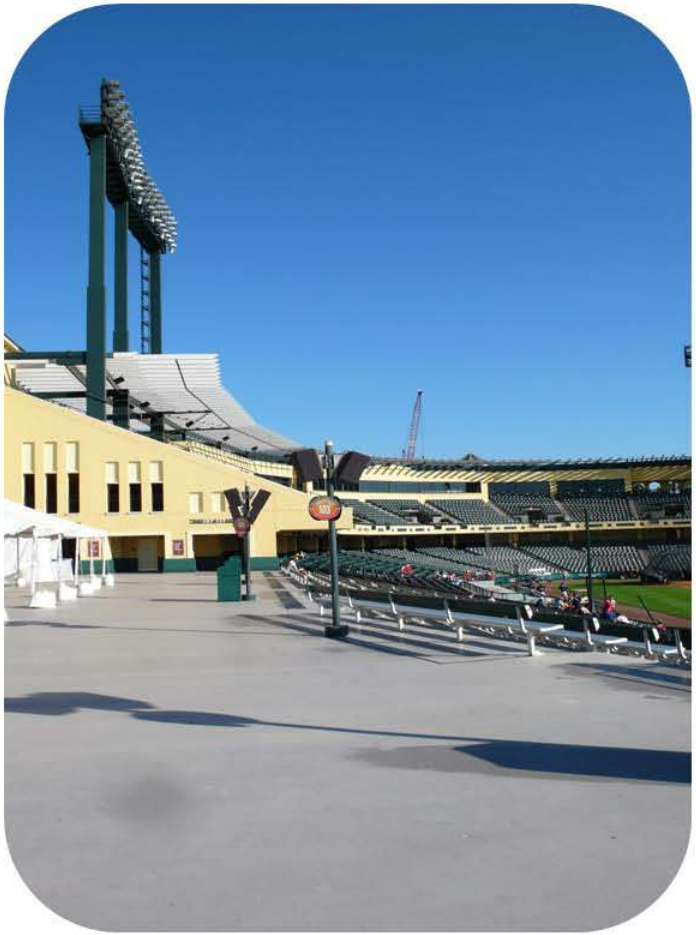
- Shield Coatings and Waterproofing Company

Supplier:

- Elastomer Specialties

System:

- Polyurethane waterproofing fluid applied membrane coated with two coats of pigmented polyaspartic topcoat



Architectural Application – Ave Maria University

80,000 ft² polyaspartic concrete coating applied to new decorative stained concrete for aesthetics, stain and abrasion resistance

Ave Maria University

General Contractor/Architect:

- Suffolk and Kraft/Cannon Design

Flooring Contractor:

- Shield Coatings and Waterproofing Company

Supplier:

- Decosup Inc.

System:

- Two coats of a clear, ADA compliant, zero-VOC polyaspartic topcoat

High Performance Coatings for Flooring Options

- Use existing damaged concrete floors by using a self leveling overlay with a high performance topcoat: Shop floors, parking decks, or commercial floors can be retasked and topcoated.
- Durable polyurethane and polyaspartic technologies that eliminate seams and grout with very fast return-to-service times: Healthcare and institutional venues like universities and hotels.
- Low odor options with excellent chemical and stain resistance: Sealing and protecting decorative stained and polished concrete in retail and commercial spaces.
- Reduce resilient floor maintenance costs and supplies: Eliminate the stripping, waxing, and burnishing process by applying permanent waterborne UV curable clearcoat technology.

Thank You!

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