TECHNICAL BULLETIN 5

CLEAR WATER REPELLENT FOR MASONRY

INTRODUCTION

1. Clear water repellents for application to concrete and masonry encompass a wide range of products, but generally only a few raw materials.
2. Clear water repellents are typically formulated from one of the following chemicals/chemical combinations:
   - Acrylics,
   - Stearates,
   - Mineral gum waxes,
   - Urethanes,
   - Silicones,
   - Silanes,
   - Siloxanes,
   - Silicates
   - Methyl siliconates.
3. The type of active ingredients used in water repellents can be characterized broadly as either film formers or penetrants.
   a. Film formers are materials that deposit their primary water-repellent component on the surface of the substrate.
   b. Penetrants enter the pore structure of the substrate and deposit their primary water-repellent component on the walls of the pores and/or in the pores themselves.

FEATURES AND BENEFITS

1. Water repellents are designed to reduce the absorption of moisture into the substrate which can lead to reduction in:
   - Freeze-thaw damage
   - Efflorescence
   - Dirt pick-up
   - Mildew and algae growth on substrates
   - Carbonation
2. The reduction of the above problems will lead to a more durable and cleaner substrate.

DESIGN CONSIDERATIONS

1. Generally, there is not a single water repellent formulation that will give optimum performance on all masonry and concrete substrates.

SUMMARY OF RAW MATERIALS

RAW MATERIAL CLASS/ ACTIVE INGREDIENT	DEFINITION
ACRYLICS	Film-forming materials manufactured by the polymerization or copolymerization of acrylic acid, methacrylic acid, or acrylonitrile and then esterified. Acrylics repel water by coating the surface of the substrate.
STEARATES	Film-forming materials consisting of aluminum or calcium salts of fatty acids. Sometimes referred to as metallic soaps. Repel water by reacting with free salts in the substrate and filling in the pores with solids.
MINERAL GUM WAXES	Film-forming material derived from paraffin wax and low-molecular weight (2000–5000) polyethylene. Repels water by forming a thin way film over the substrate.
URETHANES	Film-forming polymer based on isocyanate chemistry. Urethanes can be moisture or chemically cured. For vertical applications it is normally the former.
SILICONE RESINS	Film-forming polymer manufactured by reacting dimethychlorosilanes with water to form linear or branched polydimethylsiloxanes (PDMS) of varying molecular weight and size. Gernally supplied as a low solids mixture (5%–8%) in solvent or emulsion form.
SILANES	Penetrating monomeric alkyltrialkoxysilanes are manufactured by reacting alkene groups (olefins) with trichlorosilane followed by esterification of the chlorosilane groups. The alky functional group determines the water repellents performance. Repels water by chemically bonding with the substrate and modifying its surface tension.
SILOXANES	Penetrating partially hydrolyzed alkyltrialkoxysilane. Usually contain straight methyl alkyl groups or a mixture of methyl and higher alky groups such as butyl or octyl. Siloxanes can be described as either oligomeric or polymeric. Repels water similarly to silanes by changing the surface tension, however, higher molecular weight may form a thin surface coating.
SILICATES	Classified as penetrating material, silicates are manufactured by combining the sodium portion with the silicate protion at various ratios, yielding various grades of product. Chemically, they should impart water repellency by reacting with the free lime in the concrete (not recommended for masonry) and forming a water insoluble precipitate, however, their efficacy has yet to be proven conclusively.
SILICONATES	Penetrating material consisting of the water-soluble salts of methyl silanes. They are manufactured by reacting methyltrichlorosilane with sodium or potassium hydroxide. They repel water by reacting with carbon dioxide and chemically bonding to a neutral substrate, however, they will react very slowly, if at all, with alkaline substrates.

Manufacturers design their products for a particular type substrate. Some products are designed for concrete masonry units which tend to be porous or precast concrete which is denser. Some natural stones are not as reactive as manmade masonry and maybe softer. All these factors affect the selection of a clear water repellent.

2. Water repellents cannot solve deficiencies such as leakage through cracks, missing or damaged sealants and debonded mortar joints as these deficiencies are typically outside the performance attributes of most water repellent to correct.
   a. It is recommended to make all necessary repairs to the structure before applying a clear water repellent.

PHYSICAL PROPERTIES OF RAW MATERIALS

RAW MATERIAL/ ACTIVE INGREDIENT (GENERAL CLASS)	TYPICAL SOLIDS CONTENT	RECOMMENDED SUBSTRATE	EFFECT ON MOISTURE VAPOR TRANSMISSION	APPEARANCE OF SUBSTRATE	RESIDUE ON GLASS OR METAL	EXPECTED LIFE
ACRYLICS (FILM FORMER)	10–15%	concrete, brick, block masonry	reduces MVT	sheen or gloss	yes	1–2 years
STEARATES (FILM FORMER)	5–8%	concrete, brick, block masonry	reduces MVT	none	yes	< 1 year
MINERAL GUM WAXES (FILM FORMER)	8–12%	brick, block masonry	reduces MVT%	sheen	yes	1–2 years
URETHANES (FILM FORMER)	10–15%	concrete, brick, block masonry	reduces MVT	sheen or gloss	yes	2–3 years
SILICONE RESINS (FILM FORMER)	5–8%	brick, block concrete, masonry	reduces MVT	none	yes	2–5 years
SILANES (PENETRANT)	10–100%	concrete, brick	no effect	none	some no	3–10 years
SILOXANES (PENETRANT)	5–20%	concrete, brick, block masonry	no to slight	none	yes	2–10 years
SILICATES (PENETRANT)	3–12%	concrete	reduces	none	etches glass	< 1 year
SILICONATES (PENETRANT)	3–8%	block, concrete	no effect	none	etches glass	< 1 year

3. Water repellents are not intended for below grade waterproofing where hydrostatic pressure id a concern.
4. Check the compatibility of the clear water repellent with other building materials such as sealants, paints, repair mortars and window units.
5. Mock-ups: It is always advisable to perform a mock-up with the manufacturer and/or applicator to determine application rates, potential changes in the aesthetics (color and/ or texture and sheen) of the substrate.
   a. It is recommended that tests be performed in more than one lactioon of each substrate as absorption/ application rats may vary.
   b. RILEM tube water absorption testing can be easily run in the field to verify that the water repellent is meeting the required performance requirements.

INSTALLATION CONSIDERATIONS

1. Ambient Conditions

a. Most manufacturers require a minimum ambient and surface temperature of between 40 and 90 degrees F without threat of freezing temperatures for 12-24 hours after application.

b. Humidity should be below 90% (or less, refer to manufacturers recommendations) to encourage drying and curing.

c. Water repellents should not be applied to substrates with frost, condensation or water on the surface.

2. Substrates

a. Existing cracks, should be repaired prior to the water repellent application.

b. Porous substrates will require different application rates than smooth or dense substrates.

For more detailed information regarding other aspects of clear water repellents, please refer to the SWR INSTITUTE manual, *Clear Water Repellents for Above Grade Masonry and Horizontal Concrete Treatments*.