

CHEMICAL SEALING (GROUTING) MATERIALS

(As provided by Avanti International)

- 1 Intent: The intent of this section is to define certain properties that a sealing material should have to perform effectively in the intended application and under ambient field conditions. The intended application is to seal sewer pipe joints with a remote-controlled sealing packer (see SEWER PIPE JOINT SEALING). The materials described herein also have application in manually sealing sewer pipes and manholes (see SEWER MANHOLE SEALING).

Paragraph 3 contains a generic listing of chemical sealing materials currently in use along with some basic properties, performance standards, and mix ratios as provided by contributing manufacturers. All chemical grout manufacturers and/or suppliers must maintain product liability insurance for each product offered.

It is recognized that new chemical sealing materials may become available from time to time. Sources, manufacturers, and product names of chemical sealing materials may also change.

Each chemical sealing material listed in Paragraph 3 has discrete properties and may or may not be interchangeable with another material for a particular application or purpose. Since each application of those materials may be present differing ambient conditions (i.e., temperature, soil type and condition, presence of water, etc.), it is important that the engineer/applicator carefully considers the properties of each material to choose the appropriate chemical sealing material to be used to produce the desired results.

In every case, mixing and handling of chemical sealing materials shall be in accordance with the manufacturer's recommendations. Safety training by the manufacturer and/or supplier is a significant enhancement to the applicable safety rules and procedures and must be provided to assure that individuals who mix and handle acrylamide based chemical grouting materials receive comprehensive, hands on training. This training should include materials that have been submitted, reviewed and commented on by the USEPA. Refresher training sessions should be performed on a two-year basis, at a minimum.

- 2 General: All chemical sealing materials used in the performance of the work specified should possess properties as described in APWA publication "Assessment of Sewer Sealants" (September 1980, Office of R&D, U.S.EPA, Cincinnati, OH 45268).
- 3 Chemical Sealing Materials: The following is a generic listing of chemical sealing materials currently in use and the basic requirements, properties and characteristics of each.

(3.1) Acrylamide base gel sealing material:

- A. A minimum of 10% acrylamide base material by weight in the total sealant mix. A higher concentration (%) of acrylamide base material may be used to increase strength or offset dilution during injection.
- B. The ability to tolerate some dilution and react in moving water during injection.
- C. A viscosity of approximately 2 centipoise which can be increased with additives.
- D. A constant viscosity during the reaction period.
- E. A controllable reaction time from 10 seconds to 1 hour.

F. A reaction (curing) which produces a homogeneous, chemically stable, nonbiodegradable, firm, flexible gel.

G. The ability to increase mix viscosity, density and gel strength by the use of additives.

(3.2) Acrylic base gel chemical sealing material:

A. A minimum of 10% acrylic base material by volume in the total sealant mix. A higher concentration (%) of acrylic base material may be used to increase strength or offset dilution during injection.

B. The ability to tolerate some dilution and react in moving water during injection.

C. A viscosity of approximately 2 centipoise which can be increased with additives.

D. A constant viscosity during the reaction period.

E. A controllable reaction time from 5 seconds to 6 hours.

F. A reaction (curing) which produces a homogeneous, chemically stable, nonbiodegradable, flexible gel.

G. The ability to increase mix viscosity, density and gel strength by the use of additives.

(3.3) Urethane base gel chemical sealing material:

A. 1 part urethane prepolymer thoroughly mixed with between 5 and 10 parts of water by weight. The recommended mix ratio is 1 part urethane prepolymer to 8 parts of water (11% prepolymer).

B. A liquid prepolymer having a solids content of 77% to 83%, specific gravity of 1.04 (8.65 pounds per gallon), and a flash point of 20°F.

C. A liquid prepolymer having a viscosity of 600 to 1200 centipoises at 70°F that can be pumped through 500 feet of 1/2-inch hose with a 1000-psi head at a flow rate of 1 ounce per second.

D. The water used to react the prepolymer should have a pH of 5 to 9.

E. A cure time of 80 seconds at 40°F, 55 seconds at 60°F, and 30 seconds at 80°F when 1 part prepolymer is reacted with 8 parts of water only. Higher water ratios give longer cure times.

F. A cure time that can be reduced to 10 seconds for water temperatures of 40°F to 80°F when 1 part prepolymer is reacted with 8 parts of water containing a sufficient amount of gel control agent additive.

G. A relatively rapid viscosity increase of the prepolymer/water mix. Viscosity increases from about 10 to 60 centipoises in the first minute for 1 to 8 prepolymer/water ratio at 50°F.

H. A reaction (curing) which produces a chemically stable and nonbiodegradable, tough, flexible gel.

I. The ability to increase mix viscosity, density, gel strength and resistance to shrinkage by the use of additives to the water.

(3.4) Urethane base foam chemical sealing material:

- A. Approximately 1 part of urethane prepolymer thoroughly mixed with 1 part of water by weight (50% prepolymer).
- B. A liquid prepolymer having a solids content of 82% to 88%, specific gravity of 1.1 (9.15 pounds per gallon), and a flash point of 20°F.
- C. A liquid prepolymer having a viscosity of 300 to 500 centipoises at 72°F that can be pumped through 500 feet of 1/2-inch hose with a 500-psi head at a flow rate of 1 ounce per second.
- D. A cure time of 15 minutes at 40°F, 8.2 minutes at 70°F, and 4.6 minutes at 100°F when the prepolymer is reacted with water only.
- E. A cure time of 5.5 minutes at 40°F, 8.2 minutes at 70°F, and 2.6 minutes at 100°F when the prepolymer is reacted with water containing 0.4% accelerator.
- F. During injection; foaming, expansion, and viscosity increase occur.
- G. Physical properties of the cured foam of approximately: 14 pounds per cubic foot density, 80 to 90 psi tensile strength, and 700% to 800% elongation when a mixture of 50% prepolymer and 50% water undergoes a confined expansion to five times its initial liquid volume.

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Acrylamide and acrylic gel grouts maintain a viscosity close to that of water (2 centipoises) during the time between mixing the base material solution with the activator solution and the sudden formation of a gel. This time period is referred to as the reaction period, induction period, or gel time. The low viscosity is advantageous for penetration but makes the grouts susceptible to dilution during the reaction period.

Urethane gel grout undergoes a viscosity increase from about 10 centipoises during the time between mixing the base material with water and the formation of a gel. This time period is called the cure time. The increasing viscosity limits penetration but reduces dilution ... particularly by groundwater.