[0005] Prior attempts to address the issues mentioned herein with mineral wool insulation have been through a coating that can be applied to pipes to provide the insulation and thermal protective properties while also being relatively non-porous and preventing exposure of the pipes to moisture. Prior coating products are typically water-based and must be applied in relatively thin coats onto a hot surface (such as about 190°F to about 210°F or about 200°F) for the coatings to properly adhere to the pipes. As the products are water based, the water must be removed to form the final product, which can cause challenges in maintaining a uniform coating on the pipe or other object as the coating is dried, which can be hindered by high ambient humidity levels. Further, existing products generally require thin, multiple coats to achieve the thickness required to provide adequate insulation and thermal protective properties to the pipes, thus causing the application of this insulation to be just as, if not more, labor intensive than wrapping and cladding traditional mineral wool.

BRIEF DESCRIPTION

[0006] The subject application involves an inorganic and organic insulating polymer comprising a methyl phenyl silicone polyester with a thixotropic index from about 6 to about 9. The polyester is a polymerized reaction product between a multifunctional silicone acrylate or silicone methacrylate having a reactive functionality greater than 3 and one or more multifunctional acrylate or methacrylate monomers in the presence of an initiator and, in some approaches, also a reducer. In one approach, the polyester has a weight average molecular weight of about 2,000 to about 6,500. In another approach, the methyl phenyl silicone polyester gels within about 30 to about 60 seconds and cures within about 40 to about 80 total seconds so that it can preferably be spray applied to a pipe or other object to provide insulation and protection without sagging or deformation.

[0006a] In one aspect of the present disclosure, there is provided an inorganic and organic insulating polymer comprising a methyl phenyl silicone polyester having a thixotropic index from about 6 to about 9 that is a polymerized reaction product between a multifunctional silicone acrylate or silicone methacrylate having a reactive functionality greater than about 3 and one or more multifunctional acrylate or methacrylate monomers in the presence of an initiator.

[0007] In an embodiment, the multifunctional silicone acrylate or silicone methacrylate is the product of a reaction between a multifunctional silicone polyol with a reactive functionality of greater than about 3 to about 8 and acrylic or methacrylic acid at a temperature from about 80°C to about 150°C, and in other approaches, 100°C to about 120°C and in the presence of a catalyst and stabilizer to provide a controlled reaction. In one approach, the catalyst is one or more organic acids and the stabilizer is one or more phenolic compounds. In other approaches, the catalyst includes a strong acid and a weak acid. In yet another approach, the one or more phenolic compounds include t-butyl hydroquinone.

[0008] In an embodiment, the one or more multifunctional acrylate or methacrylate monomers are selected from a cyclic ether acrylate, a cyclic ether methacrylate, alkoxy acrylates, alkoxy diacrylates, alkoxy methacrylates, alkoxy dimethacrylates, and combinations thereof. In another aspect, the one or more multifunctional acrylate or methacrylate monomers are selected from 1,4-butanediol diacrylate or dimethacrylate, tetrahydrofurfuryl acrylate or methacrylate, and combinations thereof.

[0009] In an embodiment, the initiator is a peroxide, and preferably in another aspect, benzoyl peroxide.

[0010] In an embodiment, the polyester includes about 10% to about 30% weight percent silicone.

[0011] The subject application also involves a method of applying an inorganic and organic insulating polymer to an object to provide insulation and protection. By one approach, the method includes reacting a multifunctional silicone acrylate or silicone methacrylate having a reactive functionality greater than about 3 and one or more multifunctional acrylate or methacrylate monomers in the presence of an initiator and, in some approaches, also a reducer to form a methyl phenyl silicone polyester having a thixotropic index from about 6 to about 9. The methyl phenyl silicone polyester may be applied, such as by spraying, to the object in an amount to provide insulation wherein the methyl phenyl silicone polyester gels in about 30 to about 60 seconds and cures within about 40 to about 80 total seconds. The polyester may be applied without sagging and deformation to the outer surfaces of the object and not within a defined cavity. In some approaches, the applying includes spraying, pumping through static mix heads, brushing, coating, application via a spatula or other applicator, and combinations thereof.

[0011a] In another aspect of the present disclosure, there is provided a method of applying an inorganic and organic insulating polymer to an object to provide insulation, the method comprising:

reacting a multifunctional silicone acrylate or silicone methacrylate having a reactive functionality greater than about 3 and one or more multifunctional acrylate or methacrylate monomers in the presence of an initiator to form a methyl phenyl silicone polyester having a thixotropic index from about 6 to about 9; and

applying the methyl phenyl silicone polyester to the object in and amount to provide insulation wherein the methyl phenyl silicone polyester gels in about 30 to about 60 seconds and cures within about 40 to about 80 total seconds.

[0012] In an embodiment, the methyl phenyl silicone polyester has a weight average molecular weight of about 2,000 to about 6,500.

[0013] In an embodiment, the multifunctional silicone acrylate or silicone methacrylate is the product of a reaction between a multifunctional silicone polyol with a reactive functionality of greater than about 3 to about 8 and acrylic or methacrylic acid at a temperature from about 80°C to about 150°C (and, in other approaches, about 100 to about 120°C) and in the presence of a catalyst and stabilizer. In some approaches, the catalyst is one or more organic acids and the stabilizer is one or more phenolic compounds. In other approaches, the catalyst includes a strong acid and a weak

acids, and in yet other apaches, the one or more phenolic compounds include t-butyl hydroquinone.

[0014] In an embodiment, the one or more multifunctional acrylate or methacrylate monomers are selected from a cyclic ether acrylate, a cyclic ether methacrylate, alkoxy acrylates, alkoxy diacrylates, alkoxy methacrylates, alkoxy dimethacrylates, and combinations thereof. In some approaches, the one or more multifunctional acrylate or methacrylate monomers are selected from 1,4-butanediol diacrylate or dimethacrylate, tetrahydrofurfuryl acrylate or methacrylate, and combinations thereof.

[0015] In an embodiment, the initiator is a peroxide and, preferably, benzoyl peroxide.

[0016] In an embodiment, the polyester includes about 10% to about 30% weight percent silicone.

[0017] The above summary presents a simplified summary in order to provide an insulation including at least a multifunctional silicone acrylate or methacrylate and one or more multifunctional acrylates or methacrylates to form an organic-inorganic polymer insulating polymer suitable for pipes, conduits and other objects to provide insulation and protection.

DETAILED DESCRIPTION

[0018] The present disclosure is generally directed to spray insulating polymer coatings suitable for application to pipes, conduits, tanks, and other objects to provide insulation and protection from environmental exposure and the like. The spray insulating polymer coatings described herein may be used to cover pipes and other irregularly shaped objects, does not need to be applied or contained within defined cavities, and provides adequate insulation, heat protection, and weather protection to the pipes or other objects being covered. The material is non-aqueous, relatively easy to apply and, if sprayed on, cures in such a way and in an effective time to provide adequate properties in a single, relatively thick application or coating.

[0019] In one approach or embodiment, the insulating polymer is a methyl phenyl silicone polyester having a thixotropic index from about 6 to about 9, a gel time of about 30 to about 60 seconds, and a cure time of about 40 to about 80 total seconds. The polymer insulation is non-aqueous or a non-water based polymer that can be applied, such as spray