typically comprise of metallic-ceramic (cermet) composites and endeavor to provide high solar absorption and low thermal emittance. However, for such coatings, there are trade-offs between oxidation resistance, high absorption and low emittance. Specifically, for coatings with high absorption and low emittance, the oxidation resistance is typically compromised. Furthermore, solar selective coatings comprised of multiple layers of cermet composites to achieve properties of high solar absorption and low thermal emittance. Hence, to control the thickness of the cermet layers, precise deposition techniques, such as sputtering deposition, are used, which are relatively expensive, tedious and energy consuming.

There is thus a need to provide a coating that overcomes, or at least ameliorates, one or more of the disadvantages described above.

There is also a need to provide a cost effective method of cooling buildings.

Summary

In one aspect, there is provided a coating composition comprising a polymer matrix, comminuted microparticles comprising a mixture of silicates, silicon oxides, aluminates, aluminum oxides and zirconium oxides, said comminuted microparticles having a particle size of from 0.5 μm to 50 μm and a dispersant to disperse said comminuted microparticles in said polymer matrix, wherein the comminuted microparticles comprise nano-sized pores, wherein the comminuted microparticles are present in an amount from 10 wt% to 40 wt% of the total weight of the coating composition, and wherein said coating composition has less than 20% reflectance of solar radiation.

According to an embodiment~~a first aspect~~, there is provided a composition comprising microparticles having a particle size of from about 0.5 μm to about 50 μm with less than about 20% reflectance of solar radiation.

Advantageously, the microparticles having a particle size of from about 0.5 μm to about 50 μm confer onto the composition low reflectance values of less than about 20% reflectance of solar radiation. Hence, the disclosed composition possesses high absorbance of solar radiation.

In one embodiment, the composition absorbs solar radiation.

If the microparticles have a particle size of less than 0.5 μm, the surface area of the microparticles

increases thereby permitting the reflection of an increased amount of solar radiation, resulting in high reflectance values above 20%. On the other hand, a composition comprising microparticles having a particle size of more than 50 μm will cause cracking of coatings and will thus be more difficult to use as a coating.

In one embodiment, the microparticles comprise nano-sized pores. Advantageously, the nano-sized pores minimize the reflection of solar radiation and thus confer low reflectance onto the composition.

According to an embodiment~~a second aspect~~, there is provided a coating comprising a polymer matrix, microparticles having a particle size of from about 0.5 μm to about 50 μm and a dispersant to disperse said microparticles in said polymer matrix, wherein the coating has less than about 20% reflectance of solar radiation.

The disclosed coating may exhibit lower solar reflectance as compared to prior art coatings. Accordingly, the disclosed coating may exhibit higher solar absorbance and thus higher solar transferability, as compared to prior art coatings. Advantageously, the disclosed coating may be able to absorb larger amounts of heat from solar radiation as compared to prior art coatings.

Advantageously, the disclosed coating may be chemically stable and color stable under continuous solar radiation and high temperatures of about 100°C.

According to another~~a third~~ aspect, there is provided a method of producing a coating having less than about 20% reflectance of solar radiation, the method comprising the steps of: a. providing particles having an initial particle size of from about 0.5 μm to about 150 μm; b. mixing the particles having an initial particle size of from about 0.5 μm to about 150 μm with a polymer matrix

and a dispersant to obtain a substantially homogenous mixture; and c. comminuting the particles in said homogenous mixture to obtain the coating, wherein the coating comprises comminuted microparticles having a particle size of from about 0.5 μm to about 50 μm and wherein the comminuted microparticles comprise nano-sized pores.

The comminuting step may be undertaken under ambient conditions. Hence, the method advantageously may not require high temperature or high pressure conditions.

According to anothera ~~fourth~~ aspect, there is provided a heat exchanging system comprising at least one substrate coated with the coating composition as defined above, wherein said at least one substrate is in thermal communication with a fluid.

The heat exchanging system may be adapted to receive heat energy from solar radiation. Accordingly, the heat exchanging system may be mounted on any external surface exposed to solar radiation. Advantageously, the amount of solar radiation received and absorbed by the at least one substrate coated with the coating as defined above is maximized.

In an embodiment, the heat exchanging system is mounted on the exterior wall or the roof of buildings.

In other embodiments, the heat exchanging system may be mounted on the external surface of outdoor industrial plant equipment, such as the chemical reactors of oil refineries.

The fluid may be a heat exchange fluid adapted to absorb heat transferred from said at least one substrate.

The heat absorbed by the at least one coated substrate may be transferred to the fluid. The heated fluid may be configured to exit the heat exchanging system, thereby cooling the heat exchanging system and thus the buildings on which the system is mounted on.

According to another aspect, there is provided a paint comprising a coating composition as defined above.

Claims

1. A coating composition comprising a polymer matrix, comminuted microparticles comprising a mixture of silicates, silicon oxides, aluminates, aluminum oxides and zirconium oxides, said comminuted microparticles having a particle size of from 0.5 μm to 50 μm and a dispersant to disperse said comminuted microparticles in said polymer matrix, wherein the comminuted microparticles comprise nano-sized pores, wherein the comminuted microparticles are present in an amount from 10 wt% to 40 wt% of the total weight of the coating composition, and wherein said coating composition has less than 20% reflectance of solar radiation.

2. The coating composition of claim 1, wherein the polymer matrix is selected from the group consisting of a solvent-based organic polymer matrix and a water-based acrylic polymer matrix.

3. The coating composition of any one of the preceding claims, wherein the dispersant comprises butanol.

4. The coating composition of any one of the preceding claims, wherein the polymer matrix is present in an amount from 50 wt% to 80 wt% of the total weight of the coating composition.

5. The coating composition of any one of the preceding claims, wherein the dispersant is present in an amount from 5 wt% to 20 wt% of the total weight of the coating composition.

6. The coating composition of any one of the preceding claims, wherein the nano-sized pores have a pore size of from 1 nm to 500 nm.

~~7. The composition of any of the preceding claims, wherein the comminuted microparticles are comprised of a material selected from the group consisting of silicates, silicon oxides, aluminates, aluminum oxides, zirconium oxides and mixtures thereof.~~

~~8. The composition of any one of the preceding claims, wherein the comminuted microparticles are comprised of a mixture of silicates, silicon oxides, aluminates, aluminum oxides and zirconium oxides.~~

~~9.~~7. The coating composition of any one of the preceding claims when used to prepare a coating having less than 20% reflectance of solar radiation.

~~10.~~8. A method of producing a coating composition having less than 20% reflectance of solar radiation, the method comprising the steps of:

a. providing particles having an initial particle size of from 0.5 μm to 150 μm;

b. mixing the particles having an initial particle size of from 0.5 μm to 150 μm with a polymer matrix and a dispersant to obtain a substantially homogenous mixture, wherein the particles are selected to be present in an amount from 10 wt% to 40 wt% of the total weight of the mixture; and

c. comminuting the particles in said homogenous mixture to obtain the coating composition, wherein the coating composition comprises comminuted microparticles having a particle size of from 0.5 μm to 50 μm and wherein

the comminuted microparticles comprise nano-sized pores.

~~11.~~9. The method of claim ~~10~~8, wherein the comminuting step comprises a high shear process step.

~~12.~~10. The method of claim ~~11~~9, wherein the high shear process step is undertaken for a duration of 30 minutes to 120 minutes.

~~13.~~11. The method of any one of claims ~~11~~9-~~12~~10, wherein the high shear process step is undertaken at atmospheric temperature and pressure.

~~14.~~12. The method of any one of claims ~~10~~8-~~13~~11, wherein the particles having an initial particle size of from 0.5 μm to 150 μm are comprised of a material selected from the group consisting of silicates, silicon oxides, aluminates, aluminum oxides, zirconium oxides and mixtures thereof.

~~15.~~13. A heat exchanging system comprising at least one substrate coated with the coating composition of any one of claims 1-~~9~~7, wherein said at least one substrate is in thermal communication with a fluid.

~~16.~~14. The heat exchanging system of claim ~~15~~13, wherein the fluid is a heat exchange fluid adapted to absorb heat transferred from said at least one substrate.

~~17.~~15. The heat exchanging system of any one of claims ~~15~~13-~~16~~14, wherein said system is adapted to receive heat energy from solar radiation.

~~18.~~ 16. Paint comprising a coating composition of any one of claims 1-~~9~~7.