These disclosures all describe pre-cure addition of hydrophilic-modified oils to the coating composition, such as poly(oxyalkylene)-modified oils including silicone oils, long-chained alcohols and acrylate oils, i.e. the hydrophilic modified oil has been included in the (wet) coating composition before application on the surface of a substrate.

The fouling defence properties of the coatings described above depend on the presence of these oils in the coating. The concentration of oil has been observed to decrease over time because of different mechanisms such as degradation, diffusion, leaching, etc. (Camós et al., Progress in Organic Coatings (2017), 112: 101-108). The loss of the hydrophilic oil can lead to fouling and generally it is desired to renew the coating system before it has become completely exhausted from the hydrophilic-modified oil. The traditional way to renew the antifouling performance is by applying an entirely new coating layer or system. Application of a full fouling control coating system, or even only the fouling control layer, is time consuming and costly, and requires large amounts of coating material.

Addition of a hydrophobic silicone oil post-curing has recently been disclosed by Kolle et al. (Scientific Reports, Nature (2022) 12:11799: *On the mechanism of marine fouling-prevention performance of oil-containing silicone elastomers*). According to this post-cure method, the coated object and thus the ship hull has to be immersed completely in a (hydrophobic) silicone oil to achieve incorporation of the oil into the coat which is a cumbersome method and requires a large amount of silicone oil. Further, the polysiloxane based coat takes up the silicone oil in an amount of 45-50 wt% of the polydimethylsiloxane coat, causing the coat to swell up to 50% (from 100 µm to 150 µm). This could have a detrimental effect for the mechanical properties of the film or long-term properties.

Other documents in this technical field include WO2019/233985 and CN114 761 496.

A simple and cheap method for extending and/or improving the fouling control properties of a fouling control coat would be beneficial.

SUMMARY

In one aspect, the present disclosure provides a method for post-cure treatment of a fouling control paint coat, said method comprising the following steps:

a. applying an emulsified composition on the surface of said fouling control paint coat;

b. allowing the emulsified composition to stay in contact with the surface of said fouling control paint coat for a period of at least 2 hours;

wherein said emulsified composition comprises a liquid continuous phase comprising water and a liquid dispersed phase comprising one or more poly(oxyalkylene)-modified silicone oils.

In another aspect, the disclosure relates to the use of a method according to the disclosure for improving the fouling control properties of a fouling control paint coat.

The disclosure relates to a fouling control paint coat, preferably a non-erodible paint coat that has been treated by the method according to the disclosure.

In another aspect, the disclosure relates to a fouling control paint coat, preferably a non-erodible fouling control paint coat such as a polysiloxane-based paint coat that has been treated by the method according to the disclosure.

In another aspect, the disclosure relates to an emulsified composition for post-cure treatment of a fouling control paint coat, preferably a non-erodible fouling control paint coat such as a polysiloxane-based paint coat, the emulsified composition comprising at least a liquid continuous phase and a liquid dispersed phase, wherein the liquid continuous phase comprises water, and the liquid dispersed phase comprises one or more poly(oxyalkylene)-modified silicone oils.

Further details of the disclosure are set out in the dependent embodiments and the following description.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a method for post-cure treatment of a fouling control paint coat. The terms “fouling control paint coat” and “fouling control coat” are used interchangeably and refer to a coat obtained from a coating composition, which provides a fouling release surface, where sea organisms cannot stick or are released from the coat

when water moves along the surface. The fouling control paint coat is preferably a non-erodible paint coat, more preferably a polysiloxane-based paint coat.

The inventors have found a simple and effective post-cure treatment for a fouling control paint coat that can enhance and/or prolong the fouling control properties of the coat. Unexpectedly, the inventors found that a poly(oxyalkylene)-modified silicone oil (which is hydrophilic or amphiphilic) can be incorporated into a (hydrophobic) fouling control coat by simply applying an emulsified composition onto the surface of said fouling control coat.

In one aspect, the invention therefore simply relates to a method for incorporation of one or more poly(oxyalkylene)-modified silicone oil into a polysiloxane-based paint coat.

CLAIMS

1. A method for post-cure treatment of a fouling control paint coat, said method comprising the following steps:

a. applying an emulsified composition on the surface of said fouling control paint coat;

b. allowing the emulsified composition to stay in contact with the surface of said fouling control paint coat for a period of at least 2 hours;

wherein said emulsified composition comprises a liquid continuous phase comprising water and a liquid dispersed phase comprising one or more poly(oxyalkylene)-modified silicone oils.

2. The method according to claim 1, wherein the total amount of water constitutes between 40-99 % by weight of said emulsified composition; and the total amount of poly(oxyalkylene)-modified silicone oil constitutes between 1-40 % by weight of said emulsified composition.

3. The method according to any of claim 1 or 2, wherein said emulsified composition is allowed to stay in contact with the surface of said fouling control paint coat for a period of at least 3 hours, preferably at least 4 or 5 hours, more preferably at least 6, 7, 8, 9 or 10 hours, such as at least 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 or 24 hours.

4. The method according to any of claims 1-3, wherein said method further comprises the following step:

c. removing excess emulsified composition from the surface of said fouling control paint coat after step b, wherein said removal is performed by flushing the surface with water or by washing with a brush or a sponge.

5. The method according to any of claims 1-4, wherein said poly(oxyalkylene)-modified silicone oil is characterised by having an HLB value in the range of 1.5-14, such as 1.5-14, preferably 1.5-12, more preferably 1.5-10, such as 1.5-8 or 2-10.

6. The method according to any of claims 1-5, wherein said fouling control paint coat is a non-erodible paint coat, preferably a polysiloxane based paint coat.

7. The method according to any of claims 1-6, wherein said emulsified composition is applied at a wet film thickness of 30-400 µm, such as 50-400 µm, e.g. 75-300 µm, or 75-200, such as about 100 µm.

8. The method according to any of claims 1-7, wherein said emulsified composition is prepared from a primary composition comprising water and a secondary composition comprising poly(oxyalkylene)-modified silicone oil.

9. The method according to any of claims 1-8, wherein said emulsified composition and/or said secondary composition further comprises
i) one or more hindered amine light stabilizers; and/or
ii) one or more UV-absorbers.

10. The method according to claim 9, wherein said one or more hindered amine light stabilizer is present in an amount of 0.01-10% by weight of the emulsified composition, such as in an amount of 0.1-5%, such as 0.1-4% or 0.1-3% or 0.1-2% or 0.1-1% by weight of the emulsified composition, or in an amount of 0.01-4%, such as 0.01-3% or 0.01-2% or 0.01-1% by weight of the emulsified composition.

11. The method according to any of claims 1-10, wherein said fouling control paint coat is a freshly applied coat.

12. The method according to any of claims 1-10, wherein said fouling control paint coat is an aged coat, such as a worn-out coat.

13. The method according to any of claims 1-12 wherein said emulsified composition and/or said primary composition comprises one or more additives such as one or more rheological modifiers, such as thixotropic agents, thickening agents and/or anti-settling agents.

14. Use of a method according to any of claims 1-13 for improving the fouling control properties of a fouling control paint coat.

15. A fouling control paint coat, preferably a non-erodible fouling control paint coat such as a polysiloxane-based paint coat that has been treated by the method according to any of claims 1-13.

16. An emulsified composition for post-cure treatment of a fouling control paint coat, preferably a non-erodible fouling control paint coat such as a polysiloxane-based paint coat, the emulsified composition comprising at least a liquid continuous phase and a liquid dispersed phase, wherein the liquid continuous phase comprises water, and the liquid dispersed phase comprises one or more poly(oxyalkylene)-modified silicone oils.

17. The emulsified composition according to claim 16, wherein the total amount of water constitutes between 40-99 % by weight of said emulsified composition.

18. The emulsified composition according to claim 16 or claim 17, wherein the total amount of poly(oxyalkylene)-modified silicone oil constitutes between 1-40 % by weight of said emulsified composition.

19. The emulsified composition according to any of claims 16 to 18, wherein the composition further comprises one or more hindered amine light stabilizers, preferably being a 2,2,6,6-tetraalkyl piperidine derivative, one or more UV-absorbers, and/or one or more, preferably two or more, rheological modifiers.

20. The emulsified composition according to any of claims 16 to 19, wherein the composition comprises or consists of: at least 60 % by weight of said emulsified composition of the liquid continuous phase comprising water, 1-25 % by weight of said

emulsified composition of the one or more poly(oxyalkylene)-modified silicone oils, 1-10 % by weight of said emulsified composition of one or more hindered amine light stabilizers, preferably being a 2,2,6,6-tetraalkyl piperidine derivative, and 0.1-10 % by combined weight of said emulsified composition of two or more rheological modifiers.