Although block copolymers of siloxanes and polyurethane are known and, furthermore, the use of polyurethane as a matrix in a polymeric material comprising a polyorganosiloxane has been described in WO 2006/086092, this is the first disclosure of a composition for use in fouling release coating in which a polysiloxane and a silane terminated polyurethane are designed to co-cure.

Silane terminated polyurethanes are commercially available polymers and are described in, for example, US 5990257. As a result of their predominantly organic nature they are relatively compatible with epoxy primers and show good adhesion to such layers, as well as a variety of other substrates. The present invention represents an effective way in which to improve adhesion so that at least the link coat, and preferably also the tie coat can be eliminated from fouling release coating systems. The composition of the invention can also be applied to existing anti-fouling or fouling release coatings without having to apply a further link coat.

Summary

In one aspect, there is provided a multilayer fouling release coating comprising: (I) (I) a primer layer comprising epoxy; and (II) a layer comprising at least one polysiloxane and at least one silane terminated polyurethane. In another aspect, the present invention refers to a cured multilayer fouling release coating obtained by curing a multilayer fouling release coating of the present invention. In another aspect, the present invention refers to a process for the preparation of a fouling release coating comprising applying a layer comprising at least one curable or crosslinkable polysiloxane and at least one silane terminated polyurethane to a primer coated surface wherein said primer comprises epoxy and allowing curing to occur. In another aspect, the present invention refers to a dry kit for use in the manufacture of at least one layer in a fouling release coating comprising: (I) at least one curable or crosslinkable polysiloxane as a first part; and (II) a catalyst component as a second part; wherein either said first part or said second part additionally comprises at least one silane terminated polyurethane. In another aspect, the present invention refers to a dry kit for use in the manufacture of at least one layer in a fouling release coating comprising: (I) at least one curable or crosslinkable polysiloxane as a first part; (II) a catalyst as a second part; and (III) a crosslinking

agent as a third part; wherein either said first part or said second part or said third part additionally comprises at least one silane terminated polyurethane. In another aspect, the present invention refers to a dry kit for use in the manufacture of at least one layer in a fouling release coating comprising as claimed in the present invention: (I) at least one curable or crosslinkable polysiloxane and at least one silane terminated polyurethane as a first part; and (II) a catalyst component as a second part. In another aspect, the present invention refers to a dry kit for use in the manufacture of at least one layer in a fouling release coating comprising as claimed in the present invention: (I) at least one curable or crosslinkable polysiloxane and at least one silane terminated polyurethane as a first part; (II) a catalyst as a second part; and (III) a crosslinking agent as a third part.

In one example, there is provided a multilayer fouling release coating comprising:

(I) a primer layer; and

(II) a layer comprising at least one polysiloxane and at least one silane terminated polyurethane. Preferably said layers are adjacent.

In another example, there is provided a multilayer fouling release coating comprising:

(I) a primer layer; and

(II) a layer comprising polysiloxane and at least one silane terminated polyurethane which have been cured. Preferably said layers are adjacent.

In another example, there is provided a composition for use in the manufacture of a fouling release coating, e.g. at least one layer of a fouling release coating, comprising at least one curable or crosslinkable polysiloxane and at least one silane terminated polyurethane.

In another example, there is provided use in the manufacture of a fouling release coating, e.g. at least one layer of a fouling release coating, of a composition comprising at least one curable or crosslinkable polysiloxane and at least one silane terminated polyurethane.

In another example, there is provided a fouling release coating comprising a layer comprising at least one polysiloxane and at least one silane terminated polyurethane.

The disclosure further provides a fouling release coating comprising a layer comprising at least one polysiloxane and at least one silane terminated polyurethane which have been cured.

In another aspect, there is provided an article such as a vessel comprising a cured fouling release coating as hereinbefore defined.

In another example, there is provided use of a cured fouling release composition as herein described to prevent or reduce fouling on articles submerged in sea water.

In another example, there is provided a process for the preparation of a fouling release coating comprising applying a layer comprising at least one curable or crosslinkable polysiloxane and at least one silane terminated polyurethane to a surface and allowing curing to occur.

In another example, there is provided a kit for use in the manufacture of at least one layer in a fouling release coating comprising:

(I) at least one curable or crosslinkable polysiloxane as a first part; and

(II) a catalyst component as a second part;

wherein either said first part or said second part additionally comprises at least one silane terminated polyurethane.

In another example, there is provided a kit for use in the manufacture of at least one layer in a fouling release coating comprising:

(I) at least one curable or crosslinkable polysiloxane as a first part;

(II) a catalyst as a second part; and

(III) a crosslinking agent as a third part;

wherein either said first part or said second part or said third part additionally comprises at least one silane terminated polyurethane.

Claims

1. A multilayer fouling release coating comprising:

(I) a primer layer comprising epoxy; and

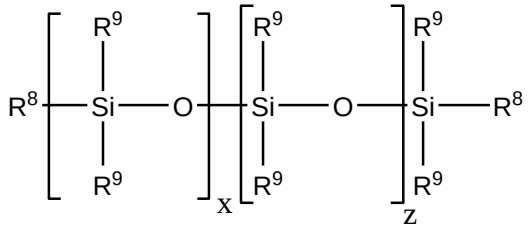
(II) a layer comprising at least one polysiloxane and at least one silane terminated polyurethane.

2. A coating as claimed in claim 1 wherein the silane terminated polyurethane has a viscosity of 5,000 mPa*s to 100,000 mPa*s (5,000 to 100,000 cP) measured at 23 °C according to ASTM D2196.

3. A coating as claimed in claim 1 or 2 wherein the polysiloxane and polyurethane are present in a weight ratio 25:1 to 1:1.

4. A coating as claimed in any of claims 1 to 3, wherein the viscosity of the polysiloxane is 40 mPa*s tp 50,000 mPa*s (40 to 50,000 cP) (measured at 23°C according to ASTM D2196).

5. A coating as claimed in any of claims 1 to 4, wherein the polysiloxane is of the general formula (I):



(I)

wherein

each R^8 is a hydroxyl, C_{1-6}-alkoxy, C_{1-6}-epoxy containing group, C_{0-6}-alkylamino group or $–O\text{-}Si(R^{10})_y(R^{11})_{(3-y)}$;

each R^9 is independently selected from C_{1-10} alkyl, C_{6-10}-aryl and C_{7-12}-alkylaryl;

R^{10} is a hydroxy or a C_{1-6} alkoxy;

R^{11} is hydrogen or a C_{1-6} alkyl;

x is an integer of at least 2
z is 0 or an integer; and
y is an integer from 1 to 3.

6. A coating as claimed in any of claims 1 to 5, further comprising a top coat layer, above the polysiloxane/polyurethane layer, which is a polysiloxane layer free of silane terminated polyurethane.

7. A cured multilayer fouling release coating obtained by curing a multilayer fouling release coating as claimed in claim 1 to 6.

8. An article such as a vessel comprising a cured fouling release coating as claimed in claim 7.

9. A process for the preparation of a fouling release coating comprising applying a layer comprising at least one curable or crosslinkable polysiloxane and at least one silane terminated polyurethane to a primer coated surface wherein said primer comprises epoxy and allowing curing to occur.

10. A dry kit for use in the manufacture of at least one layer in a fouling release coating comprising:

(I) at least one curable or crosslinkable polysiloxane as a first part; and

(II) a catalyst component as a second part;

wherein either said first part or said second part additionally comprises at least one silane terminated polyurethane.

11. A dry kit for use in the manufacture of at least one layer in a fouling release coating comprising:

(I) at least one curable or crosslinkable polysiloxane as a first part;

(II) a catalyst as a second part; and

(III) a crosslinking agent as a third part;

wherein either said first part or said second part or said third part additionally comprises at least one silane terminated polyurethane.

12. A dry kit for use in the manufacture of at least one layer in a fouling release coating comprising as claimed in claim 10:

(I) at least one curable or crosslinkable polysiloxane and at least one silane terminated polyurethane as a first part; and

(II) a catalyst component as a second part.

13. A dry kit for use in the manufacture of at least one layer in a fouling release coating comprising as claimed in claim 10:

(I) at least one curable or crosslinkable polysiloxane and at least one silane terminated polyurethane as a first part;

(II) a catalyst as a second part; and

(III) a crosslinking agent as a third part.