

Claims

1. A substrate coated with a multi-layer coating system comprising:
 - a) optionally a primer layer applied to the substrate and deposited from a primer coating composition;
 - b) a tie-coat layer applied to the substrate or to the optional primer layer, deposited from a tie-coat composition comprising a binder polymer obtainable by copolymerizing a mixture of ethylenically unsaturated monomers, the binder polymer comprising curable alkoxy silyl functional groups; and
 - c) a topcoat layer applied to the tie-coat layer, the topcoat layer deposited from a non-aqueous liquid foul release coating composition comprising a curable resin system comprising
 - i) a curable polymer having a backbone selected from a polyurethane, a polyether, a polyester, a polycarbonate or a hybrid of two or more thereof, and having at least one terminal or pendant alkoxy silyl group of formula

$$-(C_mH_{2m})-Si(R^1)_{(3-n)}(OR^2)_n \quad (I)$$
 wherein:
 - n is 1, 2 or 3, preferably 2 or 3;
 - each of R^1 and R^2 is, independently, an alkyl radical having 1 to 6 carbon atoms, preferably 1 to 4 carbon atoms;
 - m is an integer with a value in the range of from 1 to 20, and, optionally
 - ii) a curing agent and/or a catalyst,
 wherein the non-aqueous liquid foul release coating composition is essentially free of a curable polysiloxane.
2. A substrate according to claim 1, wherein the ethylenically unsaturated monomers are esters of acrylic acid and/or methacrylic acid, preferably C1-C16 esters of acrylic acid and/or methacrylic acid.

3. A substrate according to claim 1 or 2, wherein curable polymer (i) has at least one alkoxysilyl terminal group of formula (I), preferably at least two of said terminal groups.
- 5 4. A substrate according to any one of the preceding claims, wherein the at least one terminal or pendant alkoxysilyl group is attached to the backbone of the curable polymer (i) via a urethane or a urea linkage.
5. A substrate according to any one of the preceding claims, wherein m is 1
10 or 3, preferably 1.
6. A substrate according to any one of the preceding claims, wherein R² is a methyl or ethyl radical.
- 15 7. A substrate according to any one of the preceding claims, wherein the curable resin system comprises a curing agent selected from the group consisting of tetra-alkoxyorthosilicates and partial condensates thereof, organofunctional alkoxysilanes, and combinations thereof, preferably the curing agent is a tetra-alkoxyorthosilicate or a partial condensate thereof,
20 an organofunctional alkoxysilane selected from the group consisting of amino alkoxysilanes, glycidoxy alkoxysilanes, methacryloxy alkoxysilanes, carbamato alkoxysilanes, and alkoxysilanes with an isocyanurate functional group, or a combination thereof.
- 25 8. A substrate according to claim 7, wherein the curing agent is an organofunctional alkoxysilane with the alkoxysilyl functionality in an alpha position to the organofunctional group, preferably the curing agent is (N,N-diethylaminomethyl)triethoxysilane, and the coating composition is essentially free of a curing catalyst.

9. A substrate according to any one of the preceding claims, wherein the foul release coating composition is free of a marine biocide.
10. A substrate according to any one of the preceding claims, wherein the
5 foul release coating composition comprises a non-curable, non-volatile compound.
11. A substrate according to claim 10, wherein the non-curable, non-volatile compound is selected from the group consisting of fluorinated polymers,
10 sterols and sterol derivatives, and hydrophilic-modified polysiloxane oils, preferably from the group consisting of hydrophilic-modified polysiloxane oils.
12. A substrate according to claim 11, wherein the foul release coating
15 composition comprises a non-curable, non-volatile hydrophilic-modified polysiloxane oil and the non-curable, non-volatile hydrophilic-modified polysiloxane oil is a poly(oxyalkylene)-modified polysiloxane.
13. A substrate according to any one of the preceding claims, wherein the
20 curable polymer (i) is free of fluorine atoms.
14. A process for controlling aquatic biofouling on a surface of a man-made object, comprising the steps of
- 25 (a) optionally applying a primer layer on at least part of the surface of the man-made object;
- (b) applying a tie-coat layer deposited from a tie-coat composition as specified in claim 1 or 2 on at least part of the surface of the man-made object, or on the primer layer applied in step (a);
- 30 (c) applying a foul release coating composition as specified in any one of claims 1 to 13 to the applied tie-coat layer;

- (d) allowing the tie-coat composition and the foul release coating composition to cure to form a cured tie-coat layer and a cured foul release coating layer; and
- (e) immersing the man-made object at least partly in water.