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(54) HULL COVERINGS

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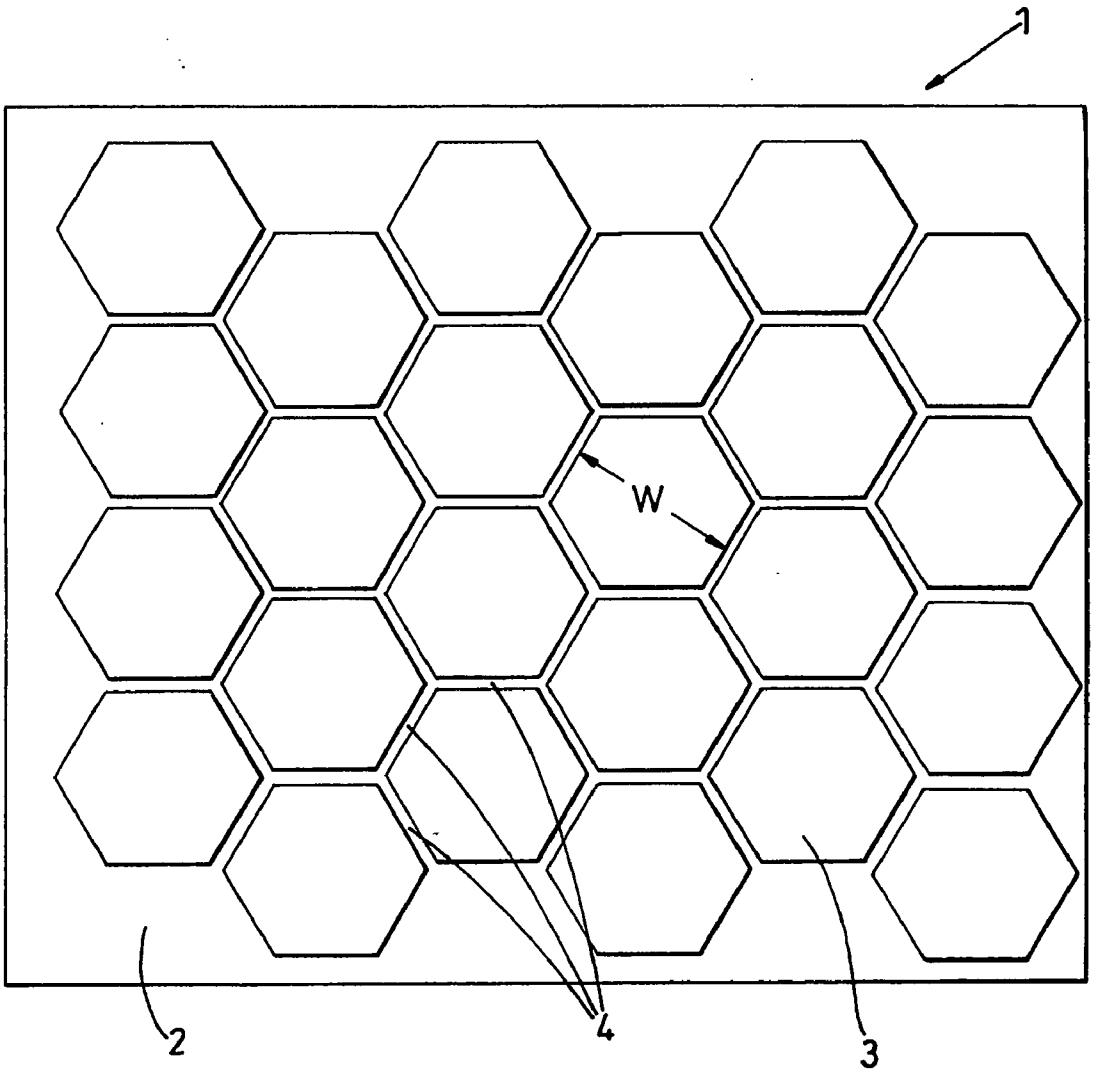
(57) **ABSTRACT**

A product for the treatment of an area of an article residing underwater. The product is constituted by a plurality of shapes formed from copper or a copper nickel alloy and a carrier film. The product is adapted in use to be secured to the area of the article residing underwater such that the shapes contact or substantially contact each other. The shapes can be releasably secured to the carrier film or permanently secured to the carrier film. Suitable methods of applying the product to the area of the article are also disclosed.



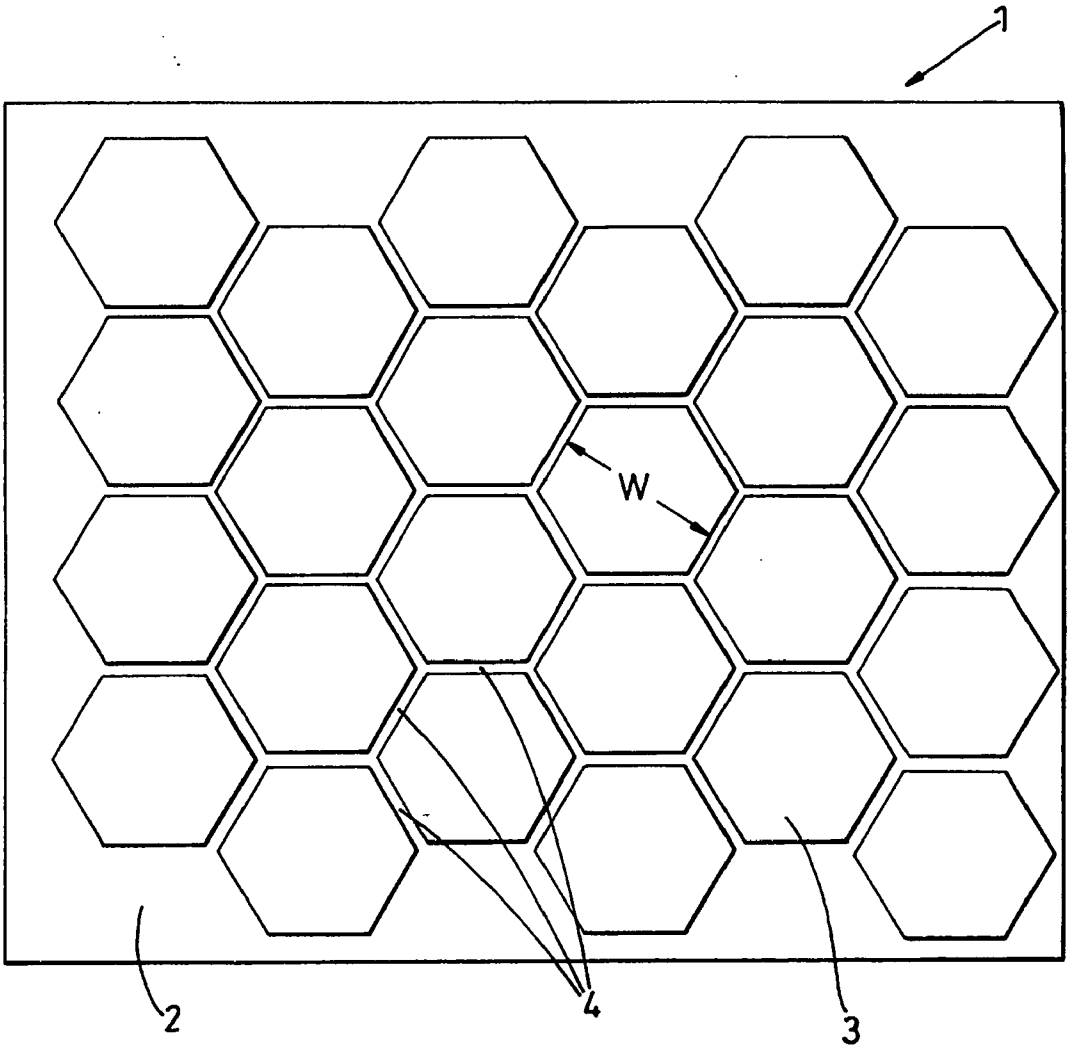


Fig. 1

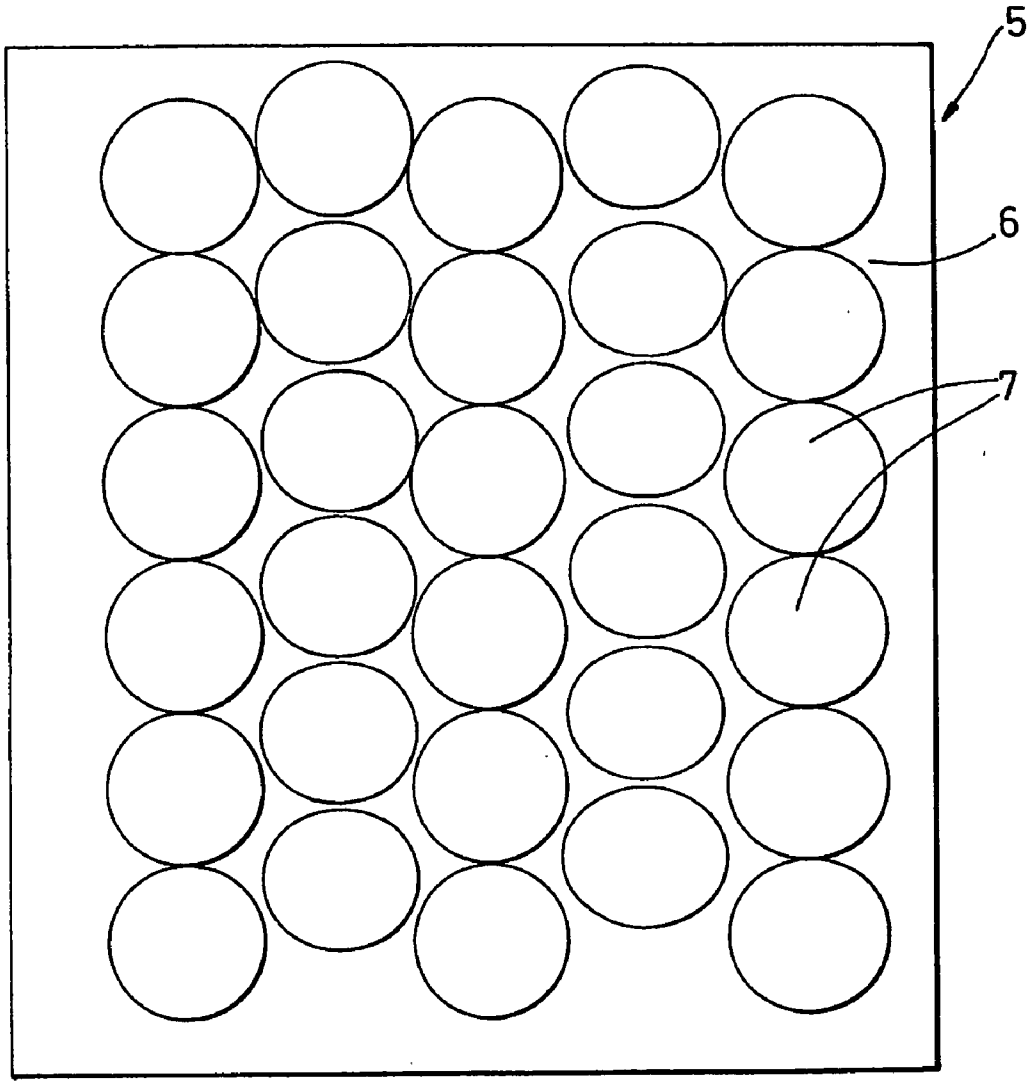


Fig. 2

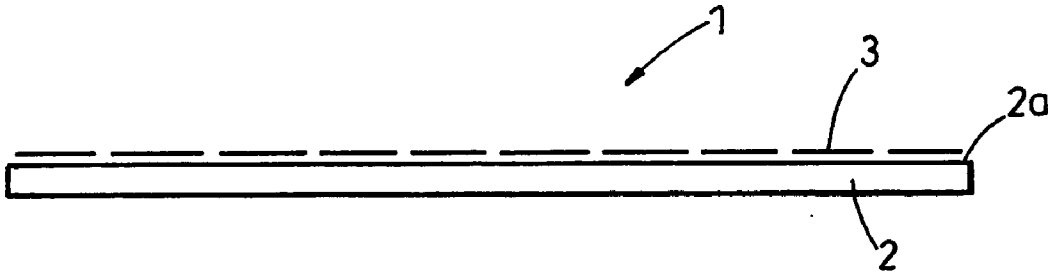


Fig. 3

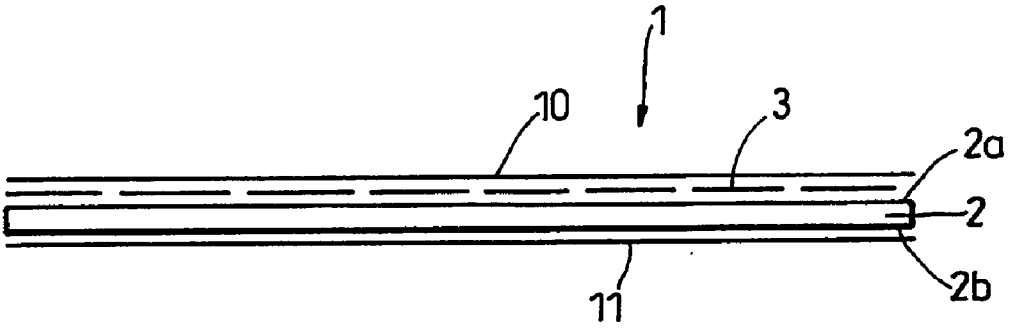


Fig. 4

HULL COVERINGS

[0001] The present invention relates to a treatment for areas of articles residing underwater, particularly the hulls of ships, to provide protection from aquatic growths and borers.

[0002] Historically ships were built of wood, however there are aquatic organisms and borers, such as Toredo worm and Gribble, that feed on the wood from which the ship hulls were built thus rendering the lives of the hulls short.

[0003] In the late 1700s copper sheathing was used to prevent infestation of wooden hulled ships by borers and it was soon realised that copper sheathing also prevented aquatic growths. However, copper sheathing could not be used on iron clad ships that were being developed around this time as the copper accelerated the corrosion process of the iron and steel through galvanic action.

[0004] The development of antifouling paints for application to areas of articles residing underwater soon followed. Early antifouling paints only contained Cuprous-Oxide as the effective ingredient and their performance was poor. Later antifouling paints contained Cuprous-Oxide, Tin and Tri-Butyl-Tin compounds (TBTs) as the effective ingredients which provided an improved performance but lead to damage of aquatic life such as shellfish stocks. The use of TBTs has now been banned on all craft under 25 metres.

[0005] In spite of the variety of antifouling paints available each has associated disadvantages in either its performance or effect on the environment. Furthermore to treat a ship hull, or any other article, with antifouling paint the ship must be removed from the water, the aquatic growth must be removed and the area to be painted must be scrubbed clean before the antifouling paint, which is both toxic to humans and the environment, can be applied. This task is ideally carried out every year and is time consuming and unpleasant and is also stressful for articles such as ships as well as being expensive.

[0006] There remains a need for a treatment for areas of ships and other articles spending considerable time underwater that is effective, lasts for more than one year and is generally environmentally friendly.

[0007] The present invention therefore provides a product for the treatment of an area of an article residing underwater comprising a plurality of shapes formed from copper or a copper nickel alloy and a carrier film and adapted in use to be secured to the area of the article residing underwater such that the shapes contact or substantially contact each other.

[0008] The copper or copper nickel alloy shapes protect wooden articles from rot and borers, protect steel from rusting, aid osmosis protection in glass reinforced polyester articles and provide a highly durable oxidised surface that inhibits aquatic growth.

[0009] Preferably the shapes are made from a copper nickel alloy.

[0010] The copper nickel alloy oxide does not leach into the sea like cuprous oxide causing damage to the environment but is generally only removed by erosion, which can occur if the article is moving at high speeds. The copper nickel alloy oxide remains effective on the surface of the alloy for a considerable time and the alloy itself therefore wears away very slowly leading to a treatment having a long lifetime, in excess of six years.

[0011] The copper nickel alloy is preferably Cupronickel 90/10. The copper nickel alloy is the effective ingredient of the product and Cupronickel 90/10 is most effective in the prevention of aquatic growth without adverse effects on the environment. Other copper nickel alloys, such as Cupronickel 70/30, can be useful if increased durability, or other properties, are required, for example for articles moving quickly through the water where erosion of Cupronickel 90/10 occurs at an unacceptable level.

[0012] The shapes are preferably interfacing shapes. The interfacing shapes are preferably adapted in use to be secured to the area of the article residing underwater such that the shapes substantially interface.

[0013] The interfacing shapes preferably have a thickness of 150 microns to 500 microns, most preferably 150 microns. The thickness of the interfacing shapes allows moulding around the shape of the article to which the interfacing shapes are being secured. The largest diameter of the shapes is preferably from 4 mm to 30 mm depending on the end application.

[0014] When in position on the area of the article there are preferably gaps between the interfacing shapes, the gaps are preferably less than 0.4 mm wide. The gap size is a compromise between a desired small size that limits the attachment area for aquatic growth and entry area for borers and the limitations of the processes for creating the gaps between the shapes. The gaps between the interfacing shapes are advantageous as they allow the interfacing shapes to be readily fitted to the shape of the area of the article being covered. Foil material used previously had to be pressed and rolled to the shape of the area of the article to be covered.

[0015] The interfacing shapes preferably have three or more sides. The most preferable interfacing shapes are hexagons and squares. Sharp corners are not desirable as they may interrupt the laminar flow of water creating drag and will be susceptible to damage; hexagons and squares are therefore ideal in shape.

[0016] Alternatively the shapes may be particulate, for example substantially spherical. The particles are preferably adapted in use to be secured to the area of the article residing underwater such that each of the particles contacts or substantially contacts adjacent particles.

[0017] The particles preferably have a diameter of less than 150 microns, more preferably less than 100 microns and most preferably less than 50 microns.

[0018] In a first aspect the shapes are releasably secured to the carrier film. The shapes are preferably releasably secured to the carrier film by an appropriate adhesive. The carrier film is preferably a plastics material capable of adopting concave and convex profiles without creasing.

[0019] The interfacing shapes are preferably secured to the carrier film to give rise to a regular pattern of shapes each preferably surrounded by small regular gaps forming a border. The border is preferably no less than 0.150 mm and no greater than 0.4 mm wide. The gaps between the interfacing shapes allow the carrier material bearing the interfacing shapes to be manipulated to fit the area of the article being covered.

[0020] Where particles are used, the particles are preferably releasably secured to the carrier film to give an even coverage of particles on the film.

[0021] The product may be provided in sheet or in strip form. The carrier film holds the shapes together during manufacture and installation and provides protection for the installed product until it is ready for use.

[0022] The carrier film is preferably standard low density polyethylene most preferably at 60 microns. The adhesive releasably securing the shapes to the carrier film is preferably an acrylic adhesive.

[0023] In a second aspect the shapes are permanently secured to one surface of the carrier film. The shapes are preferably permanently secured to the surface of the carrier film by an appropriate adhesive, preferably a solvent modified acrylic adhesive.

[0024] The carrier film is preferably a plastics material, more preferably a waterproof plastics material, capable of adopting concave and convex profiles without creasing. Most preferably, the carrier film is a waterproof polyester membrane.

[0025] Alternatively the carrier film may be acrylic foam adhesive. The shapes adhere permanently to the acrylic foam adhesive by the nature of the acrylic foam adhesive. Acrylic foam adhesive is particularly useful in deep-sea applications.

[0026] The interfacing shapes are preferably secured to the carrier film to give rise to a regular pattern of shapes each preferably surrounded by small regular gaps forming a border. The border is preferably no less than 0.150 mm and no greater than 0.4 mm wide. The gaps between the interfacing shapes allow the carrier material bearing the interfacing shapes to be manipulated to fit the area of the article being covered.

[0027] Where particles are used, the particles are preferably secured to the carrier film to give an even coverage of particles on the film.

[0028] The product may be provided in sheet or in strip form.

[0029] The carrier material is most preferably provided with an adhesive on the surface not bearing the interfacing shapes. The adhesive is preferably a solvent modified acrylic adhesive. The surface bearing the adhesive is preferably covered by a removable backing strip, which protects the adhesive until it is ready for use.

[0030] The provision of a carrier material to which the shapes are permanently secured and which is preferably provided with an adhesive surface allows easy application of the product to an article.

[0031] In the second aspect a protective film may be releasably secured, preferably by an appropriate adhesive, to the surface of the product bearing the shapes to protect the shapes during manufacture and installation. The protective film is preferably standard low density polyethylene most preferably at 60 microns. The adhesive releasably securing the protective film to the shapes is preferably acrylic adhesive.

[0032] The carrier film bearing interfacing shapes is preferably made from an appropriate carrier film material having a continuous film of copper or a copper nickel alloy secured thereto by a suitable adhesive, depending on whether the shapes are secured releasably or permanently to the carrier film. The interfacing shape pattern is preferably created by chemically etching the un-required copper nickel material with a Hydrochloric Acid based etching solution, (etchant), most preferably using either an acid resistant ink mask or dry film photo-resist. The acid resistant ink mask or dry film photo-resist has the desired pattern developed into it, and is employed to cover the copper or copper nickel alloy to remain secured to the carrier film whilst the Hydrochloric Acid based chemically dissolves the unprotected metallic materials.

[0033] Alternatively the interfacing shape pattern may be created by acid etching, most preferably using an epoxy acid resist to cover the copper or copper nickel alloy to remain secured to the carrier film and an acid to remove the unwanted material.

[0034] It may also be possible to make the product by processes such as pressing, stamping, rolling, grinding, electrical-laser processes or milling.

[0035] The product comprising a carrier material bearing particles of copper or copper nickel alloy is preferably made by applying the particles to a surface of the carrier film coated with appropriate adhesive, depending on whether the particles are releasably or permanently secured to the film. Excess non-adhered particles are preferably removed from the carrier film by vibration of the film. The particles are most preferably applied to the carrier film as it is unrolled from a first roller and re-rolled onto a second roller.

[0036] The carrier material is extremely flexible and the product can therefore readily be used to treat areas of the article having sharp edges or tight contours.

[0037] Also provided by the present invention is a method of treating an area of an article residing underwater comprising applying a plurality of shapes formed from copper or a copper nickel alloy secured to a carrier film to the area of the article residing underwater such that the shapes contact or substantially contact each other.

[0038] In a first aspect the shapes are applied to the area of the article in sheet form, releasably secured to a carrier film, most preferably by an adhesive. The use of sheet material makes the shapes easier to install.

[0039] The sheets of shapes may be applied directly to the area of the article to be covered. Preferably the area of the article to be covered is coated with a suitable adhesive system, for example an epoxy primer followed by an epoxy adhesive using a brush, roller or spraying means. The epoxy adhesive is preferably based on a bisphenol A epoxy resin reacted with an adducted polyamine to give a flexible cure. The adhesive system provides additional protection against rot, rust, borers and osmosis in addition to securing the shapes to the area of the article to be covered.

[0040] The sheets of shapes are preferably pressed into the adhesive system with the shapes contacting the adhesive system. A roller may be used to apply pressure to the sheets to ensure adhesion.

[0041] Once the adhesive system has cured the carrier film may be peeled off leaving the area of the article covered with a plurality of shapes that contact or substantially contact each other.

[0042] The shapes may alternatively be applied to areas of articles being made by moulding. Preferably the sheets of shapes are positioned within the mould with the shapes facing into the mould. The sheets of shapes may be held in position by an adhesive, preferably a heat or pressure activated adhesive. The use of a heat or pressure activated adhesive allows any necessary repositioning of the sheets before the adhesive is activated.

[0043] The shapes facing into the mould are preferably coated with a suitable adhesive system before the moulding process takes place for example using a brush, a roller or a spray means. Once the moulding process is complete the mould is removed leaving the sheets of shapes adhered to the moulded article, the carrier film is preferably then peeled off leaving the area of the article covered with shapes.

[0044] The area of the article may be treated with the product comprising the carrier film bearing the interfacing shapes or with the product comprising the carrier film bearing the particles or a combination of both types of product. Most preferably the product comprising the carrier film bearing the particles is used on areas of the article having sharp edges or tight contours and the product comprising the carrier film bearing the interfacing shapes is used on the remaining areas of the article to be covered.

[0045] In the second aspect the shapes are applied to the area of the article in sheet form, permanently secured to a surface of a carrier film, most preferably by an adhesive. The surface of the carrier film not bearing the shapes is preferably provided with an adhesive, preferably covered by a protective film. The use of sheet material, preferably having an adhesive surface makes the product easier to install.

[0046] The sheets of shapes may be applied directly to the area of the article to be covered. Preferably the area of the article to be covered is cleaned thoroughly to leave a good surface to which the product can be applied.

[0047] The adhesive surface of the carrier film is preferably pressed onto the article with the shapes facing away from the article. A roller may be used to apply pressure to the sheets to ensure adhesion.

[0048] Any protective film covering the product may be peeled off leaving the area of the article covered with a plurality of shapes that contact or substantially contact each other.

[0049] The shapes may alternatively be applied to areas of articles being made by moulding. Preferably the sheets of shapes are positioned within the mould with the shapes facing into the mould. The sheets of shapes may be held in position by an adhesive, preferably a heat or pressure activated adhesive. The use of a heat or pressure activated adhesive allows any necessary repositioning of the sheets before the adhesive is activated.

[0050] Any protective film covering the adhesive surface of the carrier film is removed. Once the moulding process is complete the mould is removed leaving the sheets of shapes adhered to the moulded article, any protective film covering the shapes is preferably then peeled off leaving the area of the article covered with shapes.

[0051] The area of the article may be treated with the product comprising the carrier film bearing the interfacing shapes or with the product comprising the carrier film bearing the particles or a combination of both types of product.

[0052] In each aspect of the invention the gaps between the shapes are preferably grouted, most preferably an epoxy grout is used.

[0053] The present invention further provides an article having an area residing underwater wherein the area is coated with a plurality of shapes formed from copper or a copper nickel alloy and wherein the shapes are arranged on the area of the article such that they contact or substantially contact each other.

[0054] The material of the present invention and the way in which it is used will now be described by means of example only with reference to the drawings in which:

[0055] **FIG. 1** shows a plan view of a product of the present invention;

[0056] **FIG. 2** shows a plan view of an alternative product of the present invention;

[0057] **FIG. 3** shows a cross section through a product of the first aspect of the invention; and

[0058] **FIG. 4** shows a cross section through a product of the second aspect of the invention.

[0059] **FIG. 1** shows a plan view of the product **1** of the present invention. The product **1** comprises a carrier film **2** and a plurality of hexagons **3** of Cupronickel 90/10 alloy secured to the carrier film **2**.

[0060] Cupronickel 90/10 alloy has the composition:

Carbon	0.05 maximum
Cobalt	0.1 maximum
Iron	1.0–2.0
Manganese	0.5–1.0
Nickel	9.0–10.0
Phosphorus	0.02 maximum
Lead	0.02 maximum
Sulphur	0.05 maximum
Tin	0.03 maximum
Zinc	0.5 maximum
Impurities	0.2 maximum
Copper	remainder

[0061] The hexagons **3** are laid out in rows on the carrier film **2** with each row being displaced by half a hexagon when compared with the adjacent row. The hexagons **3** are spaced apart from each other by a maximum of 0.4 mm in any direction which gives rise to a border **4** around each hexagon **3**. The hexagons **3** have a width (w) of 5 mm from one side to the opposing side and a thickness of 0.150 mm.

[0062] **FIG. 2** shows a plan view of an alternative product **5** of the present invention. The product **5** comprises a carrier film **2** and a plurality of spherical particles **7** of Cupronickel 90/10 alloy (composition given above) secured to the carrier

film **2**. The particles **7** are secured to the carrier film **2** by means of an appropriate adhesive.

[**0063**] The particles **7** are laid out in randomly on the carrier film **2** with each particle contacting or substantially contacting adjacent particles. The particles **7** are spaced apart from each other by a maximum of 0.4 mm in any direction. The particles **7** have a diameter (d) of 0.150 mm.

[**0064**] The product **1** is made from a carrier film **2** having a continuous film of Cupronickel 90/10 secured thereto as described below. The interfacing shape pattern is created by chemically etching the un-required copper nickel material with a Hydrochloric Acid based etching solution (etchant) using either an acid resistant ink mask or dry film photo-resist which has the desired pattern developed into it. The etchant masks used are compatible with the epoxy resins and adhesives used to secure the material **1** of the invention to an article, in the present example the article is the hull of a ship.

[**0065**] The product **5** is made by unrolling the carrier film **2** from a roll and exposing the side of the carrier film **2** bearing the adhesive to secure the shapes to the carrier film to particles **7** of Cupronickel 90/10. The particles **7** are sprinkled on the side of the carrier film **6** bearing the adhesive under the influence of gravity alone. Excess non-adhered particles **7** are removed from the carrier film **2** by vibration of the film **6**. The film coated with particles **7** is then re-rolled and stored ready for use

[**0066**] In the remainder of the description of **FIGS. 3 and 4** the reference to hexagons **3** should be construed to include particles **7**.

[**0067**] In the first aspect of the invention, shown in **FIG. 3**, the carrier film **2** is formed from standard low density polyethylene at **60** microns and has an acrylic adhesive on one surface **2***a* which is formulated to hold the hexagons **3** on the film **2** during the manufacturing and installation processes.

[**0068**] In the second aspect of the invention, shown in **FIG. 4**, the carrier film **2** is formed from a waterproof polyester membrane and has a solvent modified acrylic adhesive on one surface **2***a*, which is formulated to hold the hexagons **3** on the film **2**. The other surface **2***b* of the film **2** is provided with a solvent modified acrylic adhesive to secure the product to an article. A protective film **10** manufactured from standard low density polyethylene is provided and releasably secured to the hexagons **3** by acrylic adhesive. A protective film **11** is provided and releasably secured to the surface **2***b* provided with adhesive to protect the adhesive until the product is to be used.

[**0069**] The products of the present invention can be applied to existing ship hulls to prevent the need for future antifouling and can also be fitted to new ship hulls as they are manufactured.

[**0070**] To apply the products **1, 5** to an existing hull of a ship the same method is used with each product.

[**0071**] In the first aspect the hull is first prepared by cleaning to remove all existing aquatic growth. An epoxy primer is applied to the hull by brush to a level of 60 mm above the loaded water line. When the primer has cured an epoxy adhesive is applied to the primed hull by brush. The product **1, 5** is then applied to the hull in sheet form with the Cupronickel 90/10 shapes **3, 7** contacting the adhesive on the hull. Pressure is applied by roller to ensure that the shapes **3, 7** are forced onto the adhesive on the hull. Once the adhesive has cured the carrier film **2** can be removed by peeling it away from the shapes **3, 7** to leave the hull of the ship covered in shapes **3, 7** of Cupronickel 90/10 that contact or substantially contact each other.

[**0072**] When applying the products **1, 5** to new build ships having moulded hulls the moulds are prepared as normal. A marine architect can be used to provide plans showing how the sheets of product **1, 5** must be cut and positioned in the mould to give total coverage of the hull.

[**0073**] The prepared mould is coated with a low tack heat sensitive adhesive, which allows the sheets of product **1, 5** to be positioned, repositioned if necessary and held in position within the mould with the carrier film **2** contacting the adhesive. Once the sheets of product **1, 5** are correctly positioned a low heat source is applied and the sheets of product **1, 5** are pressed into the mould using a roller.

[**0074**] An epoxy primer is then applied to the exposed face of the product **1, 5**, i.e. the Cupronickel 90/10 shapes **3, 7**, by brush and allowed to cure following which an epoxy adhesive is applied. The hull is then prepared by moulding in a typical fashion.

[**0075**] When the hull moulding is finished it is withdrawn from the mould. Water can be used to facilitate removal of the hull from the mould. The carrier film **2** can then be peeled off to leave a new moulded hull coated with shapes **3,7** of Cupronickel 90/10 alloy that contact or substantially contact each other.

[**0076**] In treating existing or new ship hulls the product **5** bearing the particles **7** of Cupronickel 90/10 alloy is generally applied to areas of the hull having sharp edges or tight contours. The use of the particles **7** adhered to the carrier film **6** allows the product **5** to be flexible and more easily used in these areas. The product **1** bearing the interfacing hexagons **3** adhered to the carrier film **2** is generally applied to larger and more easily accessible areas of the ship hull.

[**0077**] In the second aspect the hull is first prepared by cleaning to remove all existing aquatic growth. The product **1, 5** is then applied to the hull in sheet form by removing the protective film **11** to expose the solvent modified acrylic adhesive on the surface **2***b* and applying the product to the hull with adhesive surface **2***b* contacting the hull. Pressure is applied by roller to ensure that the sheets of shapes **3, 7** are secured by adhesive to the hull. The protective film **10** can then be removed by peeling it away from the shapes **3, 7** to leave the hull of the ship covered in shapes **3, 7** of Cupronickel 90/10 that contact or substantially contact each other.

[**0078**] When applying the products **1, 5** to new build ships having moulded hulls the moulds are prepared as normal. A marine architect can be used to provide plans showing how the sheets of product **1, 5** must be cut and positioned in the mould to give total coverage of the hull.

[**0079**] The prepared mould is coated with a low tack heat sensitive adhesive, which allows the sheets of product **1, 5** to be positioned, repositioned if necessary and held in position within the mould with the carrier film **2, 6** contacting the adhesive. Once the sheets of product **1, 5** are correctly positioned a low heat source is applied and the sheets of product **1, 5** are pressed into the mould using a roller.

[**0080**] The protective sheet **11** is removed from the surface **2***b* of the carrier film to expose the solvent modified adhesive. The hull is then prepared by moulding in a typical fashion.

[0081] When the hull moulding is finished it is withdrawn from the mould. Water can be used to facilitate removal of the hull from the mould. The protective film **10** can then be peeled off to expose shapes **3**, **7** and leave a new moulded hull coated with shapes **3**, **7** of Cupronickel 90/10 alloy that contact or substantially contact each other.

1. A product for the treatment of an area of an article residing underwater, said product comprising a plurality of shapes formed from copper or a copper nickel alloy and a carrier film and adapted in use to be secured to the area of the article residing underwater such that the shapes substantially contact each other.

2. A product according to claim 1 wherein the shapes are copper nickel alloy shapes.

3. A product according to claim 2 wherein the copper nickel alloy is Cupronickel 90/10.

4. A product according to claim 1 wherein the shapes have a thickness of 150 microns to 500 microns.

5. A product according to claim 4 wherein the shapes have a thickness of 150 microns.

6. A product according to claim 1 wherein the largest diameter of the shapes is from 4 mm to 30 mm.

7. A product according to claim 1 wherein, when in position on the area of the article, there are gaps between the shapes, not greater than 0.4 mm wide.

8. A product according to claim 1 wherein the shapes are interfacing shapes.

9. A product according to claim 1 wherein the shapes are particulate.

10. A product according to claim 9 wherein the particles have a diameter of less than 150 microns.

11. A product according to claim 1 wherein the shapes are releasably secured to the carrier film.

12. A product according to claim 11 wherein the carrier film is a plastics material capable of adopting concave and convex profiles without creasing.

13. A product according to claim 11 wherein the carrier film is standard low density polyethylene.

14. A product according to claim 11 wherein the shapes are secured to the carrier film by an acrylic adhesive.

15. A product according to claim 1 wherein the shapes are permanently secured to one surface of the carrier film.

16. A product according to claim 15 wherein the shapes are permanently secured to the surface of the carrier film by a solvent modified acrylic adhesive.

17. A product according to claim 15 wherein the carrier film is a waterproof plastics materials capable of adopting concave and convex profiles without creasing.

18. A product according to claim 17 wherein the carrier film is a waterproof polyester membrane.

19. A product according to claim 15 wherein the carrier material has an adhesive on the surface not bearing the shapes.

20. A product according to claim 19 wherein the adhesive is a solvent modified acrylic adhesive.

21. A product according to claim 15 wherein a protective film is releasably secured to the surface of the product bearing the shapes to protect the shapes during manufacture and installation.

22. A product according to claim 15 wherein the carrier film is acrylic foam adhesive.

23. A product according to claim 1 wherein the product is provided in sheet or strip form.

24. A method of making the product of claim 1, said method comprising providing a carrier film material having a continuous film of copper or a copper nickel alloy secured thereto, and creating a plurality of substantially contacting shapes by chemically etching the un-required copper nickel material with an acid based etching solution.

25. A method of treating an area of an article residing underwater, said method comprising applying a plurality of shapes formed from copper or a copper nickel alloy secured to a carrier film to the area of the article residing underwater such that the shapes substantially contact each other.

26. A method according to claim 25 wherein the shapes are releasably secured to the carrier film.

27. A method according to claim 26 wherein the area of the article to be covered is coated with a suitable adhesive system, sheets of shapes are pressed into the adhesive system with the shapes contacting the adhesive system, and the carrier film is peeled off leaving the area of the article covered with a plurality of shapes that substantially contact each other.

28. A method according to claim 26 further comprising positioning the sheets of shapes within a mould with the shapes facing into the mould, coating the shapes facing into the mould with a suitable adhesive system, performing the moulding process, removing the mould, leaving the sheets of shapes adhered to the moulded article, and peeling off the carrier film, leaving the area of the article covered with shapes.

29. A method according to claim 25 wherein the shapes are permanently secured to a surface of a carrier film and the surface of the carrier film not bearing the shapes is adhesive.

30. A method according to claim 29 wherein the adhesive surface of the carrier film is pressed onto the article with the shapes facing away from the article leaving the area of the article covered with a plurality of shapes that substantially contact each other.

31. A method according to claim 29 further comprising positioning the sheets of shapes within a mould with the adhesive surface of the carrier film facing into the mould, performing the moulding process, and removing the mould, leaving the area of the article covered with shapes that substantially contact each other.

32. The method of claim 25 further comprising applying grout to the gaps between the shapes.

33. An article having an area residing underwater wherein the area is coated with a plurality of shapes formed from copper or a copper nickel alloy and wherein the shapes are arranged on the area of the article such that they substantially contact each other.

34. A method according to claim 24, further comprising providing gaps, not greater than 0.4 mm, between the shapes.

35. A method according to claim 25, further comprising providing gaps, not greater than 0.4 mm, between the shapes.

36. A method according to claim 27, further comprising providing gaps, not greater than 0.4 mm, between the shapes.

37. A method according to claim 30, further comprising providing gaps, not greater than 0.4 mm, between the shapes.

38. A method according to claim 31, further comprising providing gaps, not greater than 0.4 mm, between the shapes.

39. An article according to claim 33 wherein the shapes have gaps not greater than 0.4 mm between them.

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