Non-metallic armoring element FA1, FA2

Single-core non-metallic armored cable HA

Waterproof conductor HA1, HB1, HC1, HD1, HE1

Conductor shield layer HA2, HB2, HC2, HD2, HE2

Conductor insulation layer HA3, HB3, HC3, HD3, HE3

Insulation shield layer HA4, HB4, HC4, HD4, HE4

Waterproof buffer layer HA5, HB5, HC5, HD5

Metal shield layer HA6, HB6, HC6, HD6, HE6

Inner sheath HA7, HB7, HC7, HD7, HE7

Inner liner layer HA8, HC8, HD8

First armoring layer HA9, HB9, HC9, HD9, HE12

Wrapping tape layer HA10, HB10, HC10, HD10, HE10

Second armoring layer HA11、HB11、HC11、HD11、HE14

Outer cladding layer HA12、HB12、HC12、HD12、HE15

Single-core photoelectric composite non-metallic armored cable HB

Optical fiber unit HB8

Hybrid armored cable HC, HD

Armoring metal wire TA

Three-core non-metallic armored cable HE

First waterproof buffer layer HE5

Second waterproof buffer layer HE7

Filling layer HE9

Second inner liner layer HE11

First inner liner layer HE13

DESCRIPTION OF EMBODIMENTS

[0031] The technical solutions of the present invention will be clearly and completely described below through embodiments. Obviously, the described embodiments are only some, but not all of embodiments of the present invention. Based on the embodiments in the present

armoring element consists of a central rod body composed of a plurality of horizontally arranged non-metallic rods 1 and an outer sheath 2 extruded and wrapped outside the central rod body. According to different width specifications, the non-metallic armoring element in flat structure can contain 1-3 non-metallic rods 1 inside thereof, which are arranged horizontally to increase the mechanical strength of the flat non-metallic armoring element. In FIG. 2, two non-metallic rods 1 arranged and distributed horizontally are taken as an example, and are indicated by FA2. The non-metal armoring element FA2 has a thickness of 3-5 mm and a width of 6-8 mm, side edges of the non-metallic armoring element are all provided with arc chamfers with an arc radius of 0.2-0.8 mm.

[0036] Embodiment 1

[0037] Referring to FIG. 3, this embodiment provides a single-core non-metallic armored cable HA, which sequentially consists of a waterproof conductor HA1, a conductor shield layer HA2, a conductor insulation layer HA3, an insulation shield layer HA4, a waterproof buffer layer HA5, a metal shield layer HA6, an inner sheath HA7, an inner liner layer HA8, a first armoring layer HA9, a wrapping tape layer HA10, a second armoring layer HA11 and an outer cladding layer HA12 from inside to the outside.

[0038] The waterproof conductor HA1 is formed by layered twisting of multiple aluminum wire materials, and each layer is filled with and coated with a seawater-proof waterproof glue. The individual wires are trapezoidal in shape, and have a resistivity of not more than 0.028264 $\Omega \cdot mm^2/m$ at 20℃. The conductor is a structure type of a special-shaped wire conductor, and has a conductor section of 1600 mm^2. The waterproof conductor HA1 is extruded and wrapped with a conductor shield layer HA2, the conductor shield layer HA2 is extruded and wrapped with an XLPE insulation layer HA3, the insulation layer HA3 is extruded and wrapped with an insulation shield layer HA4. The conductor shield layer HA2, the conductor insulation layer HA3 and the insulation shield layer HA4 adopt a three-layer co-extrusion type, and are extruded at one time, shielding materials used in the conductor shield layer HA2 and the insulation shield layer HA4 are semi-conductive shield materials based on ethylene-vinyl acetate copolymer (EVA) or ethylene-ethyl acrylate (EEA), and the conductor insulation layer HA3 is formed by heating, vulcanizing and cross-linking a mixture of polyethylene resin, crosslinking agent and antioxidant.

[0039] The insulation shield layer HA4 is cladded with a waterproof buffer layer HA5,

whose material is a seawater-proof semiconductive waterproof tape with high water absorption rate and expansion rate. The waterproof buffer layer HA5 is extruded and wrapped with a metal shield layer HA6, and a material of the metal shield layer HA6 is a seamless alloy lead sleeve and has purity of not less than 99.3%. The metal shield layer HA6 is extruded and wrapped with an inner sheath HA7, and a material of the inner sheath HA7 is semi-conductive polyethylene and has a material density of 1.15 g/cm^3. The inner sheath HA7 is wrapped around the inner liner layer HA8, and the inner liner layer HA8 is a layer of polypropylene winding rope material.

[0040] The inner liner layer HA8 is twisted with a plurality of round non-metallic armoring elements FA1 to form the first armoring layer HA9 and the second armoring layer HA11. The diameter of the non-metallic armoring elements FA1 is 6.0 mm, and the two armoring layers have opposite twisting directions. A wrapping tape layer HA10 is wrapped between the two armoring layers, and the wrapping tape layer is made of high-strength wrapping tape material, such as PBT, polyester fiber tape, and glued cloth tape, and mainly plays the role of binding and fixing the first non-metallic armoring layer HA9. The second armoring layer HA11 is wrapped with two layers of reversely twisted polypropylene winding ropes as an outer cladding layer HA12.

[0041] Embodiment 2

[0042] Referring to FIG. 4, this embodiment provides a single-core photoelectric composite non-metallic armored cable HB, which sequentially consists of a waterproof conductor HB1, a conductor shield layer HB2, a conductor insulation layer HB3, an insulation shield layer HB4, a waterproof buffer layer HB5, a metal shield layer HB6, an inner sheath HB7, a optical fiber unit HB8, a first armoring layer HB9, a wrapping tape layer HB10, a second armoring layer HB11 and an outer cladding layer HB12 from inside to outside.

[0043] Where compared with Embodiment 1, the inner liner layer is removed in this structure, and meanwhile the diameter of the non-metallic armoring elements FA1 in the first armoring layer HB9 is 6.0 mm, two optical fiber units HB8 with a diameter of 5 mm are symmetrically placed in this armoring layer, and the armoring layers using the non-metallic armoring elements FA1 can play a role in protecting optical cable.

[0044] Embodiment 3

[0045] Referring to FIG. 5, this embodiment provides a hybrid armored cable HC, which sequentially consists of a waterproof conductor HC1, a conductor shield layer HC2, a conductor

insulation layer HC3, an insulation shield layer HC4, a waterproof buffer layer HC5, a metal shield layer HC6, an inner sheath HC7, an inner liner layer HC8, a first armoring layer HC9, a wrapping tape layer HC10, a second armoring layer HC11 and an outer cladding layer HC12 from inside to outside. Where except that the first armoring layer HC9 is formed by twisting a plurality of armoring copper wires TA, has a diameter of 6.0 mm, and has resistivity of not more than 0.01777 $\Omega \cdot mm^2/m$ at 20℃, the other structures and adopted materials are the same as those in the Embodiment 1. The first armoring layer HC9 is formed by twisting a plurality of armoring copper wires TA, and its main function is to improve current-carrying capacity and short-circuit current of the submarine cable.

[0046] Embodiment 4

[0047] Referring to FIG. 6, this embodiment provides a hybrid armored cable HD, which sequentially consists of a waterproof conductor HD1, a conductor shield layer HD2, a conductor insulation layer HD3, an insulation shield layer HD4, a waterproof buffer layer HD5, a metal shield layer HD6, an inner sheath HD7, an inner liner layer HD8, a first armoring layer HD9, a wrapping tape layer HD10, a second armoring layer HD11 and an outer cladding layer HD12 from inside to outside. Where both the first armoring layer HD9 and the second armoring layer HD11 are composed of a plurality of round non-metallic armoring elements FA1 and armoring metal wires TA spaced apart from the non-metallic armoring elements FA1. The specifications of the armoring wires TA are the same as those of the non-metallic armoring elements FA1, the main purpose of which is to improve the current-carrying capacity and short-circuit current transmission capacity of the submarine cable. Other structures and materials in this embodiment are the same as those in Embodiment 1.

[0048] Embodiment 5

[0049] Referring to FIG. 7, this embodiment provides a three-core non-metallic armored cable HE, and each electrical unit of the three cores is sequentially provided with a waterproof conductor HE1, a conductor shield layer HE2, a conductor insulation layer HE3, an insulation shield layer HE4, a first waterproof buffer layer HE5, a metal shield layer HE6, a second waterproof buffer layer HE7, and an inner sheath HE8 from inside to outside, the three electrical units are tangentially abutted against each other and twisted into cables, and they are externally bundled with a wrapping tape layer HE10, and a filling material is arranged between the wrapping tape layer

HE10 and the three electrical units, so as to constitute a filling layer HE9. A second inner liner layer HE11, a first armoring layer HE12, a first inner liner layer HE13, a second armoring layer HE14 and an outer cladding layer HE15 are sequentially arranged outside the wrapping tape layer HE10.

[0050] The waterproof conductor HE1 is a circular conductor structure with a tightly pressed copper core, and has a conductor section of 500 mm^2. The material of individual circular wires of conductor is a TR type of annealed copper wire, and has resistivity of not more than 0.017241 $\Omega \cdot mm^2/m$ at 20℃. The conductor shield layer HE2, the conductor insulation layer HE3 and the insulation shield layer HE4 are coextruded in three layers, where the conductor insulation layer HE3 is made of water-resistant tree type of insulation material, and the metal shield layer HE6 outside the insulation shield layer HE4 is a copper tape wrapped structure, and is made of 0.1 mm thick of copper tape material. The first waterproof buffer layer HE5 and the second waterproof buffer layer HE7 are wrapped inside and outside the metal shield layer HE6, respectively, and the material of the waterproof buffer layers is seawater-proof semiconductive waterproof tape. The inner sheath HE8 is extruded and wrapped outside the second waterproof buffer layer HE7, and the material of the inner sheath HE8 is semi-conductive polyethylene. After three inner sheaths HE8 are twisted into a cable, the interior of the cable has a filling layer HE9, the filling material of which is a polyethylene or rubber based hybrid filling strip structure, which plays a role in supporting and ensuring the roundness of the submarine cable. After forming into cable, the outer layer of the inner sheath HE8 is wrapped with a wrapping tape layer HE10, a second inner liner layer HE11, a first armoring layer HE12, a first inner liner layer HE13, a second armoring layer HE14 and an outer cladding layer HE15. Where the second inner liner layer HE11, the first inner liner layer HE13 and the outer cladding layer HE15 are all formed by twisting polypropylene winding ropes; the first armoring layer HE12 and the second armoring layer HE14 are all formed by twisting a plurality of flat non-metallic armoring elements FA2, the flat non-metallic armoring elements are 3.0 mm×7.0 mm in size, and the two layers have opposite twisting directions.

[0051] The present invention provides a non-metallic armored submarine cable, dead weight of which can be reduced by 25%-50% compared with a metal armored form, which solves the difficult problem that the weight of the submarine cable and the force borne during vertical