The present invention relates to a corrosion-protection tape for wrapping a pipe joint, the tape comprising a shear-resistant layer for contacting the pipe joint and a self-healing layer, wherein the shear-resistant layer is separated from the self-healing layer by a barrier membrane.
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CORROSION-PROTECTION TAPE

FIELD OF INVENTION

The present invention relates to a corrosion-protection tape, in particular a tape for protecting metallic pipe, pipe joints and fittings, and to a kit and method for protecting such components.

BACKGROUND OF THE INVENTION

Coated pipelines are well-known for the transmission and distribution of liquids and gases. Pipelines typically comprise metallic pipe elements. Pipe elements are typically cylindrical, several metres in length, and can be assembled contiguously, jointed, and welded to form a continuous pipeline. In buried situations, metallic pipe elements are vulnerable to corrosion.

To mitigate metallic corrosion, a corrosion protection layer is commonly applied to the external surface of the pipe elements.

The corrosion protection layer on the pipeline is known as the "mainline coating" or the "factory-applied coating" or the "parent coating".

To facilitate the jointing and welding of the pipe, and to avoid potential heat damage to the corrosion protection layer caused by heat from the welding process, the corrosion protection layer must be absent from the area of the weld and the area adjacent to the weld. The corrosion protection layer is either substantially removed from this area prior to jointing and welding, or else it is not applied to this area in the first place. This area is known as the "cutback" and typically extends around the full circumference of the pipe some 150 mm either side of the weld. The edge of the corrosion protection layer adjacent to the cutback may be chamfered or otherwise treated to facilitate subsequent coating processes.

The contiguous pipe elements formed by the jointing and welding process are protected by a corrosion protection layer, along the major portion of the pipe element. However, in the area of the cutback, where the corrosion protection layer is not present, there is an absence of protection and, after completing the jointing and welding process, application of an additional corrosion protection layer to this area is required to effect corrosion protection to the entire length of the pipeline.
In some cases, for example land-based pipeline construction, the jointing and welding of the pipe is typically carried out in-the-field. A joint formed in-the-field is known as a "field-joint". The additional corrosion protection layer applied to the "cutback", and the adjacent areas, is known as a "field-joint coating" (F-JC).

To ensure continuity between the F-JC and the mainline coating, the F-JC is typically overlapped onto the mainline coating and extended onto the mainline coating about 50 mm to 100 mm either side of the cutback area.

The F-JC is selected to be:

- compatible with the mainline coating;
- capable of application in-the-field;
- capable of being inspected in-situ by electrical means, by visual inspection, or otherwise;
- capable of rapid application and inspection (to ensure that other works, and in particular pipe burial, are not delayed);
- capable of conforming to the substrate;
- capable of maintaining adequate coating thickness over the weld;
- capable of withstanding mechanical damage caused by handling, installation, and burial; and
- capable of resisting the adverse effects of soil conditions including shear stress, abrasion, and creep.

Creep is, in essence, a long term visco-elastic, or "cold-flow" phenomenon, common to all polymeric substances. The amount of creep, however, will depend upon the physical properties of a coating. Since the physical properties (i.e. modulus) of a coating, will be temperature dependent, temperature becomes a decisive element in determining the amount of creep. At low temperatures, the propensity of the protective coating to creep will be substantially reduced, while at elevated temperatures, the likelihood of creep will be significantly increased, other factors remaining the same.

Coatings suitable for protecting pipelines from corrosion are known and include, for example, US1 7771 07 which discloses "permanently plastical protective coating for underground pipe and the like... that will not become brittle or crack". The development of this type of
compound was prompted by an investigation into gas explosions in 1925-1926 in Berlin which were found to have been caused by gas escaping from unprotected corroded gas pipe. Later the compound, in a tape form, was used to prevent stray current corrosion in pipe laid adjacent to the tracks of electrical trams.

In buried use, such coatings are typically employed in conjunction with a separate mechanically protective outer layer to reduce the risk and mitigate the harmful effects of damage from sharp stones and rocks and the like. Different types of mechanically protective outer layers can be used. Hot-applied "torch-on" products, often based on bitumen, were originally used. More recently, cold-applied filmic wraps, often based on polyethylene film or flexible PVC film, have been used. This latter type of wrap is typically stretched around the pipe helically and thereby exerts pressure, or so-called "hoop tension" on the protective coating. One advantage of this arrangement is that if the coating is mechanically punctured, there is a tendency for the underlying coating to flow into the area of damage and the system is, to some extent, self-healing. This cold flow self-healing effect is further enhanced by the inclusion of a semi-solid primer or paste applied to the pipe surface, which likewise flows into the area of damage.

This combination of a primer, a tape, and a separate outer wrap is well known in the art and has been successfully employed for the protection of buried pipe in stable or normal soil conditions for many decades. However, buried pipes can be subjected to damage during handling or installation and to shear forces once they are buried.

Shear forces acting on the pipe coating can arise from, for example, the weight of the backfill, the weight of the pipe and the weight of the contents of the pipe. Movement of the pipeline can arise from thermal expansion or contraction, and gravitational settlement of the pipeline through the soil. Movement in the soil can arise from moisture induced swelling or contraction of certain types of soil. Excessive shear forces, whatever the cause, are undesirable and can cause the coating to be displaced along the surface of the pipe.

Repeated cyclic stress may cause the coating to wrinkle and tear. This is characteristically observed at the 8 o'clock and 4 o'clock positions and can lead to failure of the protective coating system.

Whilst the shear stresses involved may be very substantial, the rate of movement of the pipe, and hence the average shear rate, is very low, of the order of 0.1 m per year.
Therefore coatings capable of resisting high shear stress, at low shear rates, are preferred where there is high risk of shear, for example, on larger diameter pipe, or in Sabkha soils.

Damage caused prior to burial can be identified by visual or electrical inspection. However, damage caused during or after burial may not be readily identified. The damage caused to the coating in buried situations, by sharp stones and rocks and the like, typically takes the form of gouging, indentation or ploughing of the coating and typically opens a wide path to the substrate.

There have been various attempts to address the requirement for a self-healing coating to address damage caused by stones and the like. For example, US6420052 discloses a coating wherein "coating encapsulated micro-spheres release the encapsulated coating material in the fluid state the coating material flows into the fissure to coat the exposed substrate. This provides a "self-healing" ability to the coating which protects the substrate even after the coating is damaged." Whilst this approach may be suited to small or hairline cracks the system cannot be adapted for pipeline protection because in pipeline situations any discontinuity in the coating, is typically large, with respect to the coating thickness, and the supply of available "healing" material adjacent to the area of damage is limited to the amount of residual material at the perimeter of the defect.

WO2005/005528 discloses a composition directed towards corrosion protection of buried pipelines that is discussed as having "self-recovering properties and any deformation or damage is repaired as a result of flow of the composition into holes or cavities caused by mechanical deformations or soil stresses". The range over which self-healing may be practically achieved is not discussed.

US4589275 discloses an "intermediate layer interposed ... to facilitate detection of pinholes and other discontinuities" and comprises a "layer of mastic which flows into and fills the irregularities of the surface".

CN203530205U discloses tapes having a mineral rock sheet backing, on which a first viscoelastic layer is provided, separated from a second viscoelastic layer by a reinforcing plastic shaping network. There is no disclosure in this document that the first and second layers should have different physical properties.
CN202755463U discloses tapes having a mineral rock sheet backing, on which a first SBR modified bitumen layer is provided, separated from a second SBR modified bitumen layer by a glass reinforced polyester felt. There is no disclosure in this document that the first and second layers should have different physical properties.

Accordingly, there remains a need for a coating that is capable of resisting high shear stress, at low shear rates and which is spontaneously self-repairing, in-situ.

**SUMMARY OF THE INVENTION**

According to a first aspect, the present invention provides a corrosion-protection tape for wrapping a pipe joint, the tape comprising a shear-resistant layer for contacting the pipe joint and a self-healing layer, wherein the shear-resistant layer is separated from the self-healing layer by a barrier membrane.

The present invention will now be further described. In the following passages different aspects of the invention are defined in more detail. Each aspect described and the individual features thereof may be combined with any other aspect or aspects unless clearly indicated to the contrary. In particular, any feature indicated as being preferred or advantageous may be combined with any other feature or features indicated as being preferred or advantageous. It will be recognised that features described in the context of one aspect may be combined with other aspects where appropriate.

The present invention relates to a corrosion-protection tape for wrapping a pipe joint. By tape it is meant a strip of material in sheet form usable to cover a surface. The tape will typically be provided on a reel for ease of use. The likely dimensions of the tape for most applications will typically be 100 mm to 450 mm in width and 10 m to 30 m in length.

By corrosion-protection it means that the tape serves to provide corrosion resistance to the wrapped substrate. Corrosion is a natural process which is the gradual destruction of metals to their oxides by chemical reaction with their environment. Thus, the tape serves to reduce or avoid contact between the metal portions of joints or pipes and their environment. By substantially excluding moisture and air the longevity of the joint is prolonged.
The tape comprises a shear-resistant layer for contacting the pipe joint and a self-healing layer. The physical properties of these layers are different.

The tape comprises a shear-resistant layer for contacting the pipe joint. The shear-resistant layer forms the contact surface and is preferably adhesive or tacky to hold it onto the pipe surface when applied. By a shear-resistant layer it is meant that the layer substantially resists shear. Such materials are known in the art as discussed above. Shear strength, which is a measure of shear resistance, can be measured using a Tinius Olsen HTE Extensometer. Preferably the measurements are taken at the intended operating temperature, such as 50°C. It is advantageous to have a high value of shear strength as this will better resist soil stress in buried pipeline situations.

Preferred values of the shear strength at 50°C for the shear-resistant layer are at least 0.25N/mm, preferably at least 0.4N/mm, preferably from 0.25 to 1.5N/mm. Typically the self-healing layer will have a shear strength at 50°C at least 0.1 N/mm, preferably at least 0.2N/mm, lower than that of the shear-resistant layer, such as below 0.25N/mm.

The tape comprises a self-healing layer. That is the tape comprises a layer made of a composition which has a sufficiently low viscosity to allow it to flow under pressure to fill any points of damage. Such materials are known in the art as discussed above. It is possible to assess the self-healing properties by measuring the yield point. This is the viscous or rheological property which is best associated with “self-healing”. When stress is applied to a material it will not flow until the applied stress exceeds a certain value. This behaviour is commonly observed when dispensing toothpaste; the toothpaste does not flow until the tube is squeezed. Similarly, in the present invention the protective compound will not flow and self-heal until the applied stress exceeds a certain value. The higher the value the greater the resistance to flow. It is therefore advantageous to have a low yield point as this will better facilitate self-healing in buried pipeline situations.

The yield point can be obtained using an Anton Paar MCR 302 Rheometer with reference to ISO 6721 :10:2015 Determination of dynamic mechanical properties - Part 10: Complex shear viscosity using a parallel-plate oscillatory rheometer. The measurements may be taken at the intended operating temperature, such as 50°C.
Preferred values of the yield point at 50 °C for the self-healing layer are at most 1500Pa, preferably at most 1000Pa, preferably from 1500 to 200Pa. Typically the self-healing layer will have a yield point at 50°C at least 1000Pa, preferably at least 2000Pa and preferably at least 2500Pa lower than that of the shear-resistant layer, such as below 900Pa. Thus the shear-resistant layer will typically have a yield point at 50°C of at least 2500Pa, preferably at least 3500Pa.

Preferably the self-healing layer will have a shear strength at 50°C at least 0.1 N/mm, preferably at least 0.2N/mm, lower than that of the shear-resistant layer, and the self-healing layer will have a yield point at 50°C at least 1000Pa, preferably at least 2000Pa and preferably at least 2500Pa lower than that of the shear-resistant layer.

As will be appreciated, the tape disclosed herein may have the composition tuned to the temperature at which it is intended to be employed. Thus, at the working temperature the layers will behave as shear-resistant and self-healing. Preferably the operating temperature of the tapes disclosed herein is from 10 to 90°C, hence measurements at 50°C are a suitable mid-point. Accordingly, in one embodiment, the present invention provides a corrosion-protection tape for wrapping a pipe joint, the tape comprising a shear-resistant layer when measured at 50°C for contacting the pipe joint and a self-healing layer when measured at 50°C, wherein the shear-resistant layer is separated from the self-healing layer by a barrier membrane.

Potable water pipes typically carry water at ambient temperatures. Accordingly, in some tropical regions it could exceptionally reach an operating temperature of up to about 50°C. In cooler climates the operating temperature will be considerably lower such as from 10-20°C. Oil pipes have a minimum operating temperature of typically 40°C. Higher temperatures may occur at the well head and there are often temperature excursions to 90°C or more when the pipe is dewaxed to maintain adequate flow. Accordingly, the overall range of operating temperatures for which the tape disclosed herein is intended for use is 10-90°C. For wrapping water pipes the range is from 10 to 50°C and for oil pipes the range is from 40 to 90°C.

The shear resistant layer and the self-healing layers are typically independently from 0.1 to 5mm thick, preferably from 0.5 to 2mm thick and most preferably about 1mm thick.
The shear resistant layer may include a fabric reinforcement. The fabric of the shear resistant layer is impregnated and coated with the shear resistant compound.

Preferably the composition forming the shear-resistant layer and/or the composition forming the self-healing layer comprise polybutene based viscoelastic material, a polyisobutylene based viscoelastic material, polymer-modified bitumen, a butyl rubber mastic or a hot melt adhesive, or mixtures of two or more thereof, and wherein the composition forming the shear-resistant layer and the composition forming the self-healing layer are different, in particular wherein the physical properties of the layers are different.

Preferably the shear-resistant layer and the self-healing layer are visibly discernible. By making the self-healing layer and/or the shear resistance layer discernible, such as with different colours or pigments in contrasting colours, the extent of any damage is obvious from visual inspection. Thus, when compared with the outermost layer, the depth of damage may be estimated.

The shear resistance of the shear-resistant layer is greater than that of the self-healing layer. Shear resistance can be measured by tensile equipment known in the art.

The viscosity of the self-healing layer is lower than that of the shear-resistant layer. Viscosity can be measured by rotational viscometry in accordance with methods known in the art.

The shear-resistant layer is separated from the self-healing layer by a barrier membrane. This layer interposed between the self-healing layer and shear resistance layer prevents co-mingling of the respective compositions. The partitioning of the self-healing layer function and shear resistance function into separate layers allows each layer to be optimally formulated in respect of its intended function.

Preferably the barrier membrane comprises polyethylene and, preferably wherein the barrier membrane has a thickness of from 5 to 25 microns, more preferably about 15microns.

Preferably the tape further comprises a backing layer provided on the self-healing layer. Such support substrates are well known in the art and may comprise a woven or non-woven fabric. This makes the tape easier to handle and apply.
Preferably the tape further comprises a releasable carrier layer provided on the shear-resistant layer for removal before use. This helps to prevent the adhesive or tacky shear-resistant layer from adhering to surfaces before use.

Preferably the carrier layer comprises siliconised polyester and, preferably, the carrier layer has a thickness of from 50 to 150 microns, more preferably about 85 microns.

The present invention provides a tape which can satisfy the conflicting requirements for providing a coating to resist damage from shear stress and which can be self-healing. To resist shear stress the coating must resist any tendency to flow, whereas to be self-healing the coating must be able to flow. Thus the requirements for self-healing and shear resistance cannot be satisfactorily reconciled by the use of a single coating composition, but can be with the claimed tape.

Moreover, when a single composition is employed, for the coating system to self-heal it must necessarily flow at all operational temperatures. However, in typical pipeline situations the temperature of the media, and hence the coating, varies during operation, shutdown, maintenance, cleaning and inspection. Moreover, there may be some seasonal fluctuation in the surrounding temperatures. Therefore compositions optimised for one particular temperature will be sub-optimal for other temperatures. Thus the provision of two compositions helps to ensure beneficial properties at different temperatures.

The tape may further comprise additional shear-resistant or self-healing compositions, optionally separated by further barrier layers, in order to provide a laminate tape. A plurality of layers may be adapted such that the function of every layer is separately optimised, in respect of shear resistance and self-repair, at a given temperature. For example, one self-repairing layer may be optimised at lower temperature and a separate self-repairing layer may be optimised to function at a higher temperature. According to a preferred embodiment, the tape comprises three such active layers, preferably including two different self-healing layers and a shear-resistant layer.

According to a further aspect there is provided a kit for providing a pipe joint with corrosion protection. The kit comprises the tape as discussed herein and a flexible wrapping tape.
The tape of the present invention can provide a pressure gradient within the self-healing layer to achieve flow into any adjacent areas of damage, such that the material displaced down the pressure gradient and seals or substantially seals the area of damage. The provision of an additional wrapping tape helps to further induce a pressure gradient to achieve this flow. The flexible wrapping tape is preferably for application separately and to be helically, circumferentially, or axially wrapped around the pipe element.

Preferably the flexible wrapping tape comprises polyethylene or PVC.

According to a further aspect there is provided a corrosion-vulnerable joint provided with a wrapping formed from the corrosion-protection tape discussed herein. By corrosion-vulnerable it is meant that the joint includes a material which is prone to corrosion if exposed to air, humidity or moisture, such as a metal joint.

Preferably the corrosion-vulnerable joint is formed between two or more metal pipes or bars. The joint typically comprises a weld. Preferably said pipes or bars are provided with a corrosion protection layer and a cut-back portion adjacent the joint, and the wrapping formed from the tape discussed herein covers at least said cutback portion. This serves to prevent corrosion in the protected area.

Preferably the corrosion-vulnerable joint is further provided with a flexible wrapping tape provided on the wrapping formed from the tape discussed herein.

According to a further aspect there is provided a method of protecting a corrosion-vulnerable joint from corrosion, the method comprising wrapping a joint with one or more layers of the tape discussed herein to form a wrapped joint and, optionally, binding the wrapped joint with a flexible wrapping tape. A detailed exemplary method of using the tape or kit to protect a joint will now be provided.

FIGURES

The present invention will now be described in relation to the following non-limiting Figures.

Figure 1 shows a cross-section showing the layers of the tape.
Figure 2 shows a cross-sectional schematic showing the layering of tape around a joint in an embodiment of the present invention.

As shown in Figure 1, the tape has a self-healing layer 1 and a shear-resistant layer 5 separated by a barrier membrane 10. The self-healing layer 1 is adjacent a backing layer 15. The shear-resistant layer 5 is provided with a removable carrier layer 20. Preferably the tape consists of these layers.

In Figure 2 the layers are as follows:

A - Weld bead  
B - Mainline coating  
C - Metal pipe  
D - Tape of the invention (first piece)  
E - Tape of the invention (second piece)  
F - Outer Wrap

As shown in Figure 2, a metal pipe joint comprising a cutback area with a central welded joint and an adjacent factory applied coating on either side of the cutback is provided. A section of tape as described herein is positioned to overlap onto the adjacent factory applied coating and to overlap onto the weld bead and to extend beyond the weld bead a distance of some 50 mm, said distance measured parallel to the major axis of the pipe. The tape is applied around the full circumference of the pipe and overlaps onto itself in the circumferential direction some 100 mm.

A separate section of tape is positioned over the remaining, substantially uncoated portion, the composite layer is positioned to overlap onto the proximal adjacent factory applied coating and to overlap onto the weld bead of the pipe and similarly overlaps onto the weld bead, and extend, beyond the weld bead, a distance of some 50 mm, said distance measured in the anti-parallel sense to the major axis of the pipe. The composite layer is applied around the full circumference of the pipe and overlaps onto itself in the circumferential direction some 100 mm.

Thus a continuous layer is formed by the application of two pieces of composite layer and a double layer of coating is provided over the weld and 50 mm either side of the weld.
A flexible outerwrap is helically applied over the composite layer and extends 100 mm onto the factory applied coating either side of the cutback area.

5 EXAMPLES

The present invention will now be described in relation to the following non-limiting examples.

10 Example 1

A laminate tape was provided having the following layers in order: a shear-resistant layer, a barrier membrane, a self-healing layer and a support layer.

15 The innermost layer of the composite, the shear resistant layer was disposed against a removable interleave comprising a film of siliconized polyester, 85 micrometres in thickness. Said interleave was removed and discarded prior to the installation of the composite.

The layer interposed between the self-healing layer and the shear resistant layer is a film of High Density Polyethylene, being 15 micrometres in thickness.

The outer layer of the composite comprises a backing layer of flexible PVC film 150 micrometres in thickness.

25 The compositions of the shear-resistant layer and the self-healing layer were as set out in the table below. The shear resistant layer is the blend of synthetic polymers and resin shown as composition A, and has a thickness of 1 mm across the layer. The composition of the self-healing layer is the blend of synthetic polymers and resin shown as composition B, and has a thickness of 1 mm across the layer.

<table>
<thead>
<tr>
<th>Composition</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Hydrocarbon Resin</td>
<td>72.0</td>
<td>76.0</td>
</tr>
<tr>
<td>(2) Thermoplastic Elastomer</td>
<td>10.0</td>
<td>6.0</td>
</tr>
<tr>
<td>(3) Paraffinic Process Oil</td>
<td>10.0</td>
<td>10.0</td>
</tr>
</tbody>
</table>
Suitable Thermoplastic elastomers may include Styrene Isoprene Styrene Block Copolymer or Styrene Butadiene Styrene Block Copolymer. The compound of the shear resistant layer may comprise a polybutene based viscoelastic material, or a polyisobutylene based viscoelastic material, or polymer modified bitumen, or a butyl rubber mastic or hot melt adhesive. The compound of the self-healing layer may comprise polybutene based viscoelastic material, or a polyisobutylene based viscoelastic material, or a polymer modified bitumen, or a butyl rubber mastic or hot melt adhesive.

Composition A and Composition B may be similar in composition; the essential feature is that the shear resistance and viscosity are different.

A flexible outer armouring was also provided comprising a self-adhesive PVC film applied helically and under tension, with a 55% overlap, to yield at least a double layer of protection.

Example 2

As for example 1, except that the outer armouring, comprises a self-adhesive polyethylene film applied helically and under tension, with a 55% overlap, to yield at least a double layer of protection.

Example 3

As for example 1, except that the outerwrap or outer armouring, comprises a heat shrinkable film, in a tape or sleeve format.

Example 4

As for example 1, except that the outer layer of the composite comprises a backing layer of flexible Polyethylene film 150 micrometres in thickness.

Example 5
As for example 1, except the following compositions were used:

<table>
<thead>
<tr>
<th>Composition</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Hydrocarbon Resin</td>
<td>73.45-71.55</td>
<td>77.45-75.55</td>
</tr>
<tr>
<td>(2) Thermoplastic Elastomer</td>
<td>9.8-10.2</td>
<td>5.8-6.2</td>
</tr>
<tr>
<td>(3) Paraffinic Process Oil</td>
<td>9-10</td>
<td>9-10</td>
</tr>
<tr>
<td>(4) Pigment</td>
<td>7.75-8.25</td>
<td>7.75-8.25</td>
</tr>
<tr>
<td>(5) Shear Strength N/mm width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>@10mm/min @50°C</td>
<td>0.48</td>
<td>0.20</td>
</tr>
<tr>
<td>(6) Yield Point Pa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>@50°C</td>
<td>3617</td>
<td>849</td>
</tr>
<tr>
<td>@40°C</td>
<td>3951</td>
<td>2033</td>
</tr>
<tr>
<td>@23°C</td>
<td>5502</td>
<td>2547</td>
</tr>
<tr>
<td>(7) Shear Strength</td>
<td>&gt; than for B</td>
<td>&lt; than for A</td>
</tr>
<tr>
<td>(8) Ratio (5A):(5B)</td>
<td>&gt;1.0</td>
<td></td>
</tr>
</tbody>
</table>

The foregoing ranges represent preferred compositions for the shear-resistant and self-healing layers.

The measured values of Shear Strength were obtained using a Tinius Olsen HTE Extensometer.

The measured values for Yield were obtained using an Anton Paar MCR 302 Rheometer with reference to ISO 6721-10:2015 Determination of dynamic mechanical properties - Part 10: Complex shear viscosity using a parallel-plate oscillatory rheometer.

As demonstrated in this example, it is advantageous to have a high value of shear strength such as greater than 0.3N/mm, preferably greater than 0.4N/mm as this will better resist soil stress in buried pipeline situations.
Example 6

As for example 1, except the following compositions were used:

<table>
<thead>
<tr>
<th></th>
<th>Shear-Resistant Layer</th>
<th>Self Healing Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kromatis 70/100 (Total Bitumen)</td>
<td>73</td>
<td>77.1</td>
</tr>
<tr>
<td>Thermoplastic Elastomer</td>
<td>4.6</td>
<td>2.4</td>
</tr>
<tr>
<td>Europrene Sol T190 (ENI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermoplastic Elastomer</td>
<td>5.4</td>
<td>3.5</td>
</tr>
<tr>
<td>Europrene Sol T6320 (ENI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paraffinic Process Oil Torilis 6200</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>(Total Lubricants)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pigment Titanium Dioxide R001</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>(Grupa Azoty)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The foregoing detailed description has been provided by way of explanation and illustration, and is not intended to limit the scope of the appended claims. Many variations in the presently preferred embodiments illustrated herein will be apparent to one of ordinary skill in the art, and remain within the scope of the appended claims and their equivalents.
Claims:

1. A corrosion-protection tape for wrapping a pipe joint, the tape comprising a shear-resistant layer for contacting the pipe joint and a self-healing layer, wherein the shear-resistant layer is separated from the self-healing layer by a barrier membrane.

2. A corrosion-protection tape according to claim 1, wherein the composition forming the shear-resistant layer and/or the composition forming the self-healing layer comprise polybutene based viscoelastic material, a polyisobutylene based viscoelastic material, polymer-modified bitumen, a butyl rubber mastic or a hot melt adhesive, or mixtures of two or more thereof, and wherein the composition forming the shear-resistant layer and the composition forming the self-healing layer are different.

3. A corrosion-protection tape according to claim 1 or claim 2, wherein the shear-resistant layer and the self-healing layer are visibly discernible.

4. A corrosion-protection tape according to any of the preceding claims, wherein the shear resistance of the shear-resistant layer is greater than that of the self-healing layer.

5. A corrosion-protection tape according to any of the preceding claims, wherein the viscosity of the self-healing layer is lower than that of the shear-resistant layer.

6. A corrosion-protection tape according to any of the preceding claims, wherein the barrier membrane comprises polyethylene and, preferably wherein the barrier membrane has a thickness of from 5 to 25 microns.

7. A corrosion-protection tape according to any of the preceding claims, further comprising a backing layer provided on the self-healing layer.

8. A corrosion-protection tape according to any of the preceding claims, further comprising a releasable carrier layer provided on the shear-resistant layer for removal before use.
9. A corrosion-protection tape according to any of the preceding claims, wherein the carrier layer comprises siliconised polyester and, preferably, wherein the carrier layer has a thickness of from 50 to 150 microns.

10. A kit for providing a pipe joint with corrosion protection, the kit comprising the tape according to any of claims 1 to 9 and a flexible wrapping tape.

11. The kit according to claim 10, wherein the flexible wrapping tape comprises polyethylene or PVC.

12. A corrosion-vulnerable joint provided with a wrapping formed from the corrosion-protection tape according to any of claims 1 to 9.

13. The corrosion-vulnerable joint according to claim 12, wherein the corrosion-vulnerable joint is formed between two or more metal pipes or bars, and, preferably, wherein the joint comprises a weld.

14. The corrosion-vulnerable joint according to claim 13, wherein said pipes or bars are provided with a corrosion protection layer and a cut-back portion adjacent the joint, and wherein the wrapping formed from the tape according to any of claims 1 to 9 covers at least said cutback portion.

15. The corrosion-vulnerable joint according to any of claims 12 to 14, wherein the corrosion-vulnerable joint is further provided with a flexible wrapping tape provided on the wrapping formed from the tape according to any of claims 1 to 9.

16. A method of protecting a corrosion-vulnerable joint from corrosion, the method comprising wrapping a joint with one or more layers of the tape according to any of claims 1 to 9 to form a wrapped joint and, optionally, binding the wrapped joint with a flexible wrapping tape.
Figure 2
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

<table>
<thead>
<tr>
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According to International Patent Classification (IPC) and/or both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B32B F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>CN 203530205 U (SICHUAN TIANYI COMHEART TELECOM CO LTD) 9 April 2014 (2014-04-09) cited in the application</td>
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<td>GB 2284785 A (GRACE W R LTD [GB]) 21 June 1995 (1995-06-21)</td>
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[X] Further documents are listed in the continuation of Box C.  [X] See patent family annex.

* Special categories of cited documents:

A: Document defining the general state of the art which is not considered to be of particular relevance.

E: Earlier application or patent but published on or after the international filing date.

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O: Document referring to an oral disclosure, use, exhibition or other means.

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A: Document member of the same patent family.

Date of the actual completion of the international search: 19 April 2017

Date of mailing of the international search report: 26/04/2017

Name and mailing address of the ISA:

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Authorized officer:

Matthijssen, J-J

Form PCT/ISA/210 (second sheet) (April 2005)
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**Explanation:**

- **Category:** X and Y
- **Citation:** Wo 2014/131127 Al and Wo 2005/005528 Al
- **Document:** SHAWCOR LTD [CA] and FRANS NOOREN AFDICHTINGSSYSTEM [NL]; NOOREN FRANS [NL]
- **Date:** 4 September 2014 and 20 January 2005
- **Relevant Passages:** Indicated by page numbers and line numbers
- **Relevant to Claim No.:** 1-5, 7, 12-14, 16 and 10, 11, 15
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