metallurgical integrity bond, but is very expensive. Mechanical cladding includes forming the cladding material into a tube, inserting this tube into the candidate pipe, and mechanically expanding the liner. This is a more cost effective method of lining pipe, but no metallurgical bond is formed between the liner and the substrate. Thus, there is an ongoing need for a more effective, less expensive method for creating clad pipe for use in oil and gas applications.

SUMMARY OF THE INVENTION

[0004] The following provides a summary of certain exemplary embodiments of the present invention. This summary is not an extensive overview and is not intended to identify key or critical aspects or elements of the present invention or to delineate its scope.

[0005] In accordance with one aspect of the present invention, a first system for creating a clad ~~material~~ structure is provided. This system includes at least one substrate component, wherein the at least one substrate component is adapted for use in acidic, caustic, abrasive, or oxidizing environments; at least one cladding layer, (i) wherein the at least one cladding layer further includes oxidation, corrosion, or abrasion resistant materials, and (ii) wherein the at least one cladding layer is adapted to be bound to the at least one substrate component for allowing the at least one substrate component to be utilized in acidic, caustic, abrasive, or oxidizing environments; and at least one surface activation layer disposed between the at least one substrate component and the at least one cladding layer, (i) wherein the surface activation layer is chemically deposited, cold sprayed, or plated onto either the substrate component or the cladding layer, (ii) wherein the surface activation layer affects both the at least one substrate component and the at least ono cladding layer, and (iii) wherein the surface activation layer includes a melting point suppressant; and a resistance seam welder, wherein the resistance seam welder is operative to ~~generate~~ apply heat and pressure ~~sufficient~~ to ~~react~~ the at least one surface activation layer ~~and~~ sufficient to form a bond between the at least one substrate component and the at least one cladding layer when the at least one surface activation layer ~~is~~ has sufficiently cooled following the application of heat and pressure thereto.

[0006] In accordance with another aspect of the present invention, a second system for creating a clad material is provided. This system includes at least one metal substrate; at least one oxidation and corrosion resistant cladding layer; at least one surface activation layer disposed between the at least one substrate and the at least one cladding layer, wherein the at

least one surface activation layer further includes at least one eutectic alloy; and a resistance seam welder. The resistance seam welder is operative to generate heat and pressure sufficient to react the at least one surface activation layer and form a bond between the at least one substrate and the at least one cladding layer when the at least one surface activation layer is sufficiently cooled.

[0007] In yet another aspect of this invention, a clad ~~material~~ structure is provided. This clad ~~material~~ structure includes at least one substrate component, wherein the at least one substrate component is adapted for use in acidic, caustic, abrasive, or oxidizing environments; at least one cladding layer, (i) wherein the at least one cladding layer further includes oxidation, corrosion, or abrasion resistant materials, and (ii) wherein the at least one cladding layer is adapted to be bound to the at least one substrate component for allowing the at least one substrate component to be utilized in acidic, caustic, abrasive, or oxidizing environments; and at least one surface

activation layer disposed between the at least one substrate component and the at least one cladding layer, (i) wherein the surface activation layer is chemically deposited, cold sprayed, or plated onto either the substrate component or the cladding layer, (ii) wherein the surface activation layer affects both the at least one substrate component and the at least on cladding layer, (iii) wherein the surface activation layer includes a melting point suppressant, (iv) wherein the. ~~The~~ at least one surface activation layer is adapted to be responsive to a resistance seam welder, and (v) wherein the resistance seam welder is operative to ~~generate~~ apply heat and pressure ~~sufficient~~ to ~~react~~ the at least one surface activation layer ~~and~~ sufficient to form a bond between the at least one substrate component and the at least one cladding layer when the at least one surface activation layer ~~is~~ has sufficiently cooled following the application of heat and pressure thereto.

[0008] Additional features and aspects of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the following detailed description of the exemplary embodiments. As will be appreciated by the skilled artisan, further embodiments of the invention are possible without departing from the scope and spirit of the invention. Accordingly, the drawings and associated descriptions are to be regarded as illustrative and not restrictive in nature.

DESCRIPTION OF THE DRAWINGS

[0009] The accompanying drawings, which are incorporated into and form a part of the specification, schematically illustrate one or more exemplary embodiments of the invention and, together with the general description given above and detailed description given below, serve to explain the principles of the invention, and wherein:

[0010] FIG. 1 is a first perspective view of a clad structure in accordance with an exemplary embodiment of the present invention;

[0011] FIG. 2 is a second perspective view of a clad structure in accordance with an exemplary embodiment of the present invention showing the placement of a welding wheel on the interior of the structure;

[0012] FIG. 3 is a third perspective view of a clad structure in accordance with an exemplary embodiment of the present invention showing the placement of a welding wheel

on the interior of the structure, a welding wheel on the exterior of the structure, and a base plate and rollers on one end of the structure; and

CLAIMS

What is claimed:

(1) A system for creating a clad ~~material~~structure, comprising:

(a) at least one substrate component, wherein the at least one substrate component is adapted for use in acidic, caustic, abrasive, or oxidizing environments;

(b) at least one cladding layer,

(i) wherein the at least one cladding layer further includes oxidation, corrosion, or abrasion resistant materials, and

(ii) wherein the at least one cladding layer is adapted to be bound to the at least one substrate component for allowing the at least one substrate component to be utilized in acidic, caustic, abrasive, or oxidizing environments;

(c) at least one surface activation layer disposed between the at least one substrate component and the at least one cladding layer,

(i) wherein the surface activation layer is chemically deposited, cold sprayed, or plated onto either the substrate component or the cladding layer,

(ii) wherein the surface activation layer affects both the at least one substrate component and the at least on cladding layer, and

(iii) wherein the surface activation layer includes a melting point suppressant; and

(d) a resistance seam welder, wherein the resistance seam welder is operative to ~~generate~~ apply heat and pressure ~~sufficient~~ to ~~react~~ the at least one surface activation layer ~~and~~ sufficient to form a bond between the at least one substrate component and the at least one cladding layer when the at least one surface activation layer ~~is~~ has sufficiently cooled following the application of heat and pressure thereto.

(2) The system of claim 1, wherein the geometry of the substrate component is substantially flat.

(3) The system of claim 1, wherein the geometry of the substrate component is substantially round.

(4) The system of claim 1, wherein the at least one substrate pipeline further includes steel.

~~(5) The system of claim 1, wherein the at least one cladding layer further includes an oxidation, corrosion, and abrasion resistant material.~~

~~(6)~~(5) The system of claim 1, wherein the at least one cladding ~~layer is selected from the group consisting of~~includes stainless steel, tool steel, Inconel alloy, ~~and~~ or refractory metals.

~~(7)~~(6) The system of claim 1, wherein the at least one surface activation layer ~~further~~ includes at least one Ni-Cr-Fe-B eutectic alloy.

~~(8)~~(7) The system of claim 1, wherein the at least one surface activation layer ~~is selected from the group consisting of~~includes nickel phosphorus alloys ~~and~~ or nickel boron alloys.

~~(9)~~(8) The system of claim 1, wherein the surface activation layer is deposited on the at least one substrate prior to creation of ~~a clad material~~the clad structure.

~~(10)~~(9) The system of claim 1, wherein the surface activation layer is deposited on the at least one cladding layer prior to creation of ~~a clad material~~the clad structure.

(10) The system of claim 1, wherein the substrate component is a line pipe.

~~(11) A system for creating a clad material, comprising:~~

~~(a) at least one metal substrate;~~

~~(b) at least one oxidation and corrosion resistant cladding layer;~~

~~(c) at least one surface activation layer disposed between the at least one substrate and the at least one cladding layer, wherein the at least one surface activation layer further includes at least one eutectic alloy; and~~

~~(d) a resistance seam welder, wherein the resistance seam welder is operative to generate heat and pressure sufficient to react the at least one surface activation layer and form a bond between the at least one substrate and the at least one cladding layer when the at least one surface activation layer is sufficiently cooled.~~

~~(12) The system of claim 11, wherein the geometry of the substrate is substantially flat.~~

~~(13) The system of claim 11, wherein the geometry of the substrate is substantially round.~~

~~(14) The system of claim 11, wherein the surface activation layer is deposited on the at least one substrate prior to creation of a clad material.~~

~~(15) The system of claim 11, wherein the surface activation layer is deposited on the at least one cladding layer prior to creation of a clad material.~~

~~(16)~~(11) A clad ~~material~~structure, comprising:

(a) at least one substrate component, wherein the at least one substrate component is adapted for use in acidic, caustic, abrasive, or oxidizing environments;

(b) at least one cladding layer,

(i) wherein the at least one cladding layer further includes oxidation, corrosion, or abrasion resistant materials, and

(ii) wherein the at least one cladding layer is adapted to be bound to the at least one substrate component for allowing the at least one substrate

component to be utilized in acidic, caustic, abrasive, or oxidizing environments; and

(c) at least one surface activation layer disposed between the at least one substrate component and the at least one cladding layer,

(i) wherein the surface activation layer is chemically deposited, cold sprayed, or plated onto either the substrate component or the cladding layer,

(ii) wherein the surface activation layer affects both the at least one substrate component and the at least on cladding layer,

(iii) wherein the surface activation layer includes a melting point suppressant;

(iv) wherein the at least one surface activation layer is adapted to be responsive to a resistance seam welder, and

(v) wherein the resistance seam welder is operative to ~~generate~~ apply heat and pressure ~~sufficient~~ to ~~react~~ the at least one surface

activation layer ~~and~~ sufficient to form a bond between the at least one substrate component and the at least one cladding layer when the at least one surface activation layer has sufficiently ~~is~~ cooled following the application of heat and pressure thereto.

~~(17)~~(12) The clad ~~material~~ structure of claim ~~16~~11, wherein the at least one substrate component further includes pipeline steel.

~~(18) The clad material of claim 16, wherein the at least one cladding layer further includes an oxidation, corrosion, and abrasion resistant material.~~

~~(19)~~(13) The clad ~~material~~ structure of claim ~~16~~11, wherein the at least one cladding layer ~~is selected from the group consisting of~~includes stainless steel, tool steel, Inconel alloy, ~~and~~ or refractory metals.

~~(20)~~(14) The clad ~~material~~ structure of claim ~~16~~11, wherein the at least one surface activation ~~layer is selected from the group consisting of~~includes Ni-Cr-Fe-B eutectic alloys, nickel phosphorus alloys, ~~and~~ or nickel boron alloys.

(15) The clad structure of claim 11, wherein the substrate component is a line pipe.