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LONGEVITY AND PERFORMANCE IMPROVEMENTS TO FLARE TIPS**FIELD OF THE INVENTION**

The present invention relates generally to flare tips employed in the petrochemical industry for burning off-gases associated with the production and/or refining of petroleum-based products. In especially preferred forms, the present invention relates to flare tips coated with a low emissivity (low-E) material so as to improve the longevity and performance thereof.

BACKGROUND AND SUMMARY OF THE INVENTION

Flare tips are notoriously well known in the petroleum industry and are used typically to burn off-gases associated with petroleum production and/or refining. Flare tips are therefore exposed to direct flame during their service life which can of course be quite damaging. As a result, flare tips need to periodically be taken out of service and refurbished which adds to production costs.

It would therefore be highly desirable if the service life of flare tips could be extended. It would also be especially desirable if the performance characteristics of flare tips could be enhanced. It is towards fulfilling such needs that the present invention is directed.

Broadly, the present invention is directed to applying a low emissivity (low-E) coating onto flare tips to achieve longer flare tip service life, improved flare tip structural integrity and/or a more stable flame pattern under a wide range of operating conditions. In accordance with some embodiments of the present invention, low-E coatings may be

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applied to the flare tip burner as well as associated internal and/or external component surfaces to reduce direct flame radiation and also conductive heat transfer.

5 In accordance with some embodiments of the invention, the low-E coating material has an emissivity of less than about 0.80, preferably between about 0.20 to about 0.78. The coating thickness of the low-E material is preferably between about 1 mil to about 25 mils, and more preferably between about 2 mils to about 8 mils. Coating densities of the low-E material in the coating will preferably be at least about 65%, more
10 preferably between about 80% to about 100%.

The improved flare tips in accordance with the present invention therefore result in significantly less deformation and distortion of the flare tip burner as well as its associated internal and/or external components thereby prolonging its useful service life. The low-E ceramic coatings of
15 the present invention will also provide enhanced corrosion and oxidation resistance and further improve the longevity of the flare tip burner as well as its associated internal and/or external components.

These and other aspects and advantages will become more apparent after careful consideration is given to the following detailed
20 description of the preferred exemplary embodiments thereof.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

Reference will hereinafter be made to the accompanying drawings, wherein like reference numerals throughout the various FIGURES denote like structural elements, and wherein;

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FIGURE 1 is a perspective view of an exemplary flare tip in accordance with the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

According to a presently preferred embodiment of the present invention, a low emissivity (low-E) coating material is applied to the flare tip burner as well as associated internal and/or external component surfaces to reduce direct flame radiation and also conductive heat transfer. An exemplary flare tip 10 is depicted in accompanying FIGURE 1 as having a flare barrel 12 which terminates in a baffled burner element 14. Flame stabilization tabs 16 are provided at circumferentially spaced-apart locations about the burner element 14 so as to ensure stable and high efficiency flaring through a range of gas flows. According to especially preferred embodiments of the present invention, all exterior and interior surfaces of the flare tip 10 which may have exposure to the flame and its attendant radiation are coated with a low-E ceramic material. Coated structures therefore include, for example, at least an upper portion of the flare barrel 12, the burner element 14, and/or the stabilization tabs 16.

As used herein, the emissivity (E) of a material is meant to refer to a unitless number measured on a scale between zero (total energy reflection) and 1.0 (a perfect "black body" capable of total energy absorption and re-radiation). According to the present invention, a relatively low emissivity (low-E) is meant to refer to coating materials having an emissivity of less than about 0.80, and especially materials having an emissivity of between about 0.20 to about 0.78.

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Virtually any commercially available low-E coating material may be employed satisfactorily in the practice of the present invention. For example, one presently preferred low-E ceramic coating includes CERAK M700 ceramic coating commercially available from Cetek, Ltd. of Berea, Ohio, having an emissivity of about 0.75.

Coating thicknesses of the low-E ceramic coating material are not critical but will vary in dependence upon the desired resulting thermal flux and/or the particular material forming the coating. Thus, coating thicknesses of from about 1 mil to about 25 mils, usually about 2 mils to about 8 mils may be appropriate. Coating densities will typically be greater than about 65%, more specifically 80% or greater. Coating densities will typically be greater than about 65%, more specifically 80% or greater, including up to 100%. By "coating density" is meant the amount (wt.%) of the low-E ceramic coating material that is present in the coating.

The low-E coating material may be applied to flare tip components in any conventional manner. The low-E coating material may thus be applied to the flare tip components via any pressurized spray system while the flare tip is being manufactured or while off-line (i.e., is not at its operational temperatures) during refurbishment.

The present invention will be further understood from the following non-limiting Example.

EXAMPLE

A high temperature low-emissivity coating (CETEK M720 high-temperature ceramic coating having an emissivity value of about 0.75) was applied to a flare tip manufactured by Callidus Technologies LLC.

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The low-E coating utilized a non-toxic, non-flammable carrier, with a high temperature ceramic binder and was sprayed onto the flare tip structures to be exposed to direct flame during operation by conventional spray equipment. The sprayed coating was thereafter allowed to dry in air for 4
5 hours and cured at 1500⁰F. After curing, the coating on the flare tip surfaces exhibited a thickness of about 3 mils at a coating density of the low-E material of about 100%. The coating was intended to provide excellent thermal barrier protection, oxidation and corrosion resistance to metallic substrates at elevated temperatures up to 2400⁰F, as well as a
10 reduction in warpage, stress corrosion cracking, and alloy leaching. The coating also was intended to provide uniform heat distribution for enclosed flare systems.

The flare tip with the low-E coating material applied thereto was placed into service to burn off-gases. After approximately six months of
15 continuous operation, the condition of the coated flare tip surfaces was visually inspected and determined to be satisfactory indicating that the coating material provided protection against the direct flame during flare tip operation.

20 While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various
modifications and equivalent arrangements included within the spirit and
25 scope of the appended claims.

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CLAIMS:

1. A method of improving service longevity and performance of a flare tip comprising applying a coating comprised of a low emissivity (low-E) material to one or more component surfaces of the flare tip so as to reduce direct flame radiation and conductive heat transfer during flare tip operation.
2. Method as in claim 1, wherein the coating is applied to surfaces of a flare barrel, a burner element and/or a stabilization tab of the flare tip.
3. Method as in claim 1 or 2, wherein the surface(s) to which the coating is applied are exposed to a direct flame during flare tip operation.
4. Method as in any preceding claim, wherein the flare tip includes a flare tip burner, and wherein the method comprising applying the coating to the burner.
5. Method as in claim 4 further comprising applying the coating to internal and/or external components of the flare tip other than the burner.
6. Method as in any preceding claim, wherein the low-E coating material has an emissivity of less than about 0.80.
7. Method as in claim 6, wherein the low-E material has an emissivity of from about 0.20 to about 0.78.
8. Method as in any preceding claim, wherein the coating of the low-E material has a thickness of between about 1 mil to about 25 mils.

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9. Method as in claim 8, wherein the thickness is between about 2 mils to about 8 mils.

10. Method as in any preceding claim, wherein the low-E material is present in the coating at a density of at least about 65%.

11. Method as in claim 10, wherein the density of the low-E material in the coating is between about 80% to about 100%.

12. A flare tip which comprises a coating on one or more component surfaces thereof comprised of a low-emissivity (low-E) material.

13. A flare tip as in claim 12, wherein the flare tip comprises a flare barrel, a burner element and at least one stabilization tab, and wherein the coating is applied to surfaces of at least one of the flare barrel, the burner element and the stabilization tab.

14. A flare tip as in claim 12 or 13, wherein the coating is on surfaces of the flare tip which are exposed to a direct flame during flare tip operation.

15. A flare tip as in any one of claims 12 to 14, wherein the flare tip includes a flare tip burner, and wherein the coating is applied to the burner.

16. A flare tip as in claim 15, wherein the coating is applied to internal and/or external components of the flare tip other than the burner.

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17. A flare tip as in any one of claims 12 to 16, wherein the low-E coating material has an emissivity of less than about 0.80.

18. A flare tip as in claim 17, wherein the low-E material has an emissivity of from about 0.20 to about 0.78.

19. A flare tip as in any one of claims 12 to 18, wherein the coating of the low-E material has a thickness of between about 1 mil to about 25 mils.

20. A flare tip as in claim 19, wherein the thickness is between about 2 mils to about 8 mils.

21. A flare tip as in any one of claims 12 to 20, wherein the low-E material is present in the coating at a density of at least about 65%.

22. A flare tip as in claim 21, wherein the density of the low-E material in the coating is between about 80% to about 100%.