CLAIMS

1. A method of determining the presence of an alumina layer on a surface of a component, an aluminium containing layer being arranged on the surface of the component and an alumina layer being arranged on the aluminium containing layer, the method comprising the steps of:-

a) directly illuminating a surface of a component with radiation at a suitable wavelength to produce excitation of electrons from a normal energy state to a higher energy state in any alumina on the surface of the component,

b) detecting radiation emitted at a particular wavelength by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component,

c) analysing the radiation emitted by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component to determine the thickness of the alumina at at least one point on the surface of the component,

d) comparing the determined thickness of the alumina at the at least one point on the surface of the component with a predetermined thickness of alumina at that point on the surface of the component to decide if the thickness of alumina at the at least one point on the surface of the component is satisfactory.

2. A method as claimed in claim 1 wherein step c) comprises analysing the radiation emitted by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component to determine the thickness of the alumina at a plurality of points on the surface of the component and step d) comprises comparing the determined thickness of the alumina at each of the plurality of points on the surface of the component with a predetermined thickness of alumina at each of the plurality of points on the surface of the component to decide if the thickness of alumina at each of the plurality of points on the surface of the component is satisfactory.

3. A method as claimed in claim 1 or claim 2 wherein step c) comprises analysing the radiation emitted by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component to determine the thickness of the alumina at each point on the surface of the

component and step d) comprises comparing the determined thickness of the alumina at each point on the surface of the component with a predetermined thickness of alumina at that point on the surface of the component to decide if the thickness of alumina at each point on the surface of the component is satisfactory.

4. A method as claimed in claim 1, claim 2 or claim 3 wherein the suitable wavelength is ultraviolet radiation, radiation in the blue region of the radiation spectrum or radiation in the green region of the radiation spectrum.

5. A method as claimed in claim 1, claim 2, claim 3 or claim 4 wherein the suitable wavelength is 488nm, 505nm, 514nm or 530nm.

6. A method as claimed in any of claims 1 to 5 wherein the particular wavelength is in the range of 692nm to 696nm.

7. A method as claimed in any of claims 1 to 6 wherein step a) comprises illuminating the surface of the component with radiation from at least one light emitting diode or radiation from at least one laser.

8. A method as claimed in any of claims 1 to 7 wherein step b) comprises detecting radiation with a camera.

9. A method as claimed in claim 7 wherein step a) comprises illuminating the surface of the component with radiation from a plurality of light emitting diodes arranged in an array around a camera.

10. A method as claimed in any of claims 1 to 9 wherein the method comprises placing the component in a radiation tight enclosure and illuminating an external surface of the component.

11. A method as claimed in any of claims 1 to 9 wherein the method comprises inserting a boroscope into the component and illuminating an internal surface of the component.

12. A method as claimed in any of claims 1 to 11 wherein the component is a component of a gas turbine engine.

13. A method as claimed in claim 12 wherein the component is a turbine blade or a turbine vane.

14. A method as claimed in any of claims 1 to 13 wherein the aluminium containing layer is an aluminide layer, a platinum aluminide layer, a silicon aluminide layer, a chromium aluminide layer or a MCrAlY layer, where M is

nickel, cobalt or a combination of nickel and cobalt, Cr is chromium, Al is aluminium and Y is yttrium.

15. An apparatus for determining the presence of an alumina layer on a surface of a component, an aluminium containing layer being arranged on the surface of the component and an alumina layer being arranged on the aluminium containing layer, the apparatus comprising means to directly illuminate a surface of a component with radiation at a suitable wavelength to produce excitation of electrons from a normal energy state to a higher energy state in any alumina on the surface of the component, means to detect radiation emitted at a particular wavelength by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component, means to analyse the radiation emitted by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component to determine the thickness of the alumina at at least one point on the surface of the component and means to compare the determined thickness of the alumina at the at least one point on the surface of the component with a predetermined thickness of alumina at that point on the surface of the component to decide if the thickness of alumina at the at least one point on the surface of the component is satisfactory.

16. An apparatus as claimed in claim 15 wherein the means to illuminate the surface of the component is arranged to illuminate the surface of the component with ultraviolet radiation, radiation in the blue region and/or radiation in the green region of the radiation spectrum.

17. An apparatus as claimed in claim 15 or claim 16 wherein the means to illuminate the surface of the component is arranged to illuminate the surface of the component with radiation at wavelength of 488nm, 505nm, 514nm or 530nm.

18. An apparatus as claimed in any of claims 15 to 17 wherein the means to detect radiation is arranged to detect radiation at a wavelength in the range of 692nm to 696nm.

19. An apparatus as claimed in any of claims 15 to 18 wherein the means to illuminate the surface of the component with radiation comprises at least one light emitting diode and at least one laser.

20. An apparatus as claimed in any of claims 15 to 19 wherein the means to detect radiation comprises a camera.

21. An apparatus as claimed in claim 19 wherein the means to illuminate the surface of the component comprises a plurality of light emitting diodes arranged in an array around a camera.

22. An apparatus as claimed in claim 20 wherein the camera has a red band-pass filter.

23. An apparatus as claimed in claim 19 wherein the at least one light emitting diode has a green short-pass filter, a blue filter, an ultraviolet filter or a short pass filter which blocks red light.

24. An apparatus as claimed in any of claims 15 to 23 wherein the apparatus comprises a radiation tight enclosure and the means to illuminate the surface of the component is arranged to illuminate an external surface of the component and the means to illuminate the surface of the component and the means to detect radiation are arranged in the light tight enclosure.

25. An apparatus as claimed in any of claims 15 to 23 wherein the apparatus comprises a boroscope to illuminate an internal surface of the component.

The invention claimed is:

1. A method of determining the presence of an alumina layer on a surface of a component, an aluminium containing layer being arranged on the surface of the component and an alumina layer being arranged on the aluminium containing layer, the method comprising the steps of:

a) directly illuminating a surface of a component with radiation at a suitable wavelength to produce excitation of electrons from a normal energy state to a higher energy state in any alumina on the surface of the component,

b) detecting radiation emitted at a particular wavelength by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component,

c) analysing the radiation emitted by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component to determine the thickness of the alumina at at least one point on the surface of the component,

d) comparing the determined thickness of the alumina at the at least one point on the surface of the component with a predetermined thickness of alumina at that point on the surface of the component to decide if the thickness of alumina at the at least one point on the surface of the component is satisfactory.

2. A method as claimed in claim 1 wherein step c) comprises analysing the radiation emitted by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component to determine the thickness of the alumina at a plurality of points on the surface of the component and step d) comprises comparing the determined thickness of the alumina at each of the plurality of points on the surface of the component with a predetermined thickness of alumina at each of the plurality of points on the surface of the component to decide if the thickness of alumina at each of the plurality of points on the surface of the component is satisfactory.

3. A method as claimed in claim 1 wherein step c) comprises analysing the radiation emitted by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component to determine the thickness of the alumina at each point on the surface of the component and step d) comprises comparing the determined thickness of the alumina at each point on the surface of the component with a predetermined thickness of alumina at that point on the surface of the component to decide if the thickness of alumina at each point on the surface of the component is satisfactory.

4. A method as claimed in claim 1 wherein the suitable wavelength is selected from the group consisting of ultraviolet radiation, radiation in the blue region of the radiation spectrum and radiation in the green region of the radiation spectrum.

5. A method as claimed in claim 1 wherein the suitable wavelength is selected from the group consisting of 488 nm, 505 nm, 514 nm and 530 nm.

6. A method as claimed in claim 1 wherein the particular wavelength is in the range of 692 nm to 696 nm.

7. A method as claimed in claim 1 wherein step a) comprises illuminating the surface of the component with radiation from at least one light emitting diode.

8. A method as claimed in claim 1 wherein step b) comprises detecting radiation with a camera.

9. A method as claimed in claim 7 wherein step a) comprises illuminating the surface of the component with radiation from a plurality of light emitting diodes arranged in an array around a camera.

10. A method as claimed in claim 1 wherein step a) comprises illuminating the surface of the component with radiation from at least one laser.

11. A method as claimed in claim 1 wherein the method comprises placing the component in a radiation tight enclosure and illuminating an external surface of the component.

12. A method as claimed in claim 1 wherein the method comprises inserting a baroscope into the component and illuminating an internal surface of the component.

13. A method as claimed in claim 1 wherein the component is a component of a gas turbine engine.

14. A method as claimed in claim 13 wherein the component is a turbine blade or a turbine vane.

15. A method as claimed in claim 1 wherein the aluminium containing layer is an aluminide layer, a platinum aluminide layer, a silicon aluminide layer, a chromium aluminide layer or a MCrAlY layer, where M is nickel, cobalt or a combination of nickel and cobalt, Cr is chromium, Al is aluminium and Y is yttrium.

16. An apparatus for determining the presence of an alumina layer on a surface of a component, an aluminium containing layer being arranged on the surface of the component and an alumina layer being arranged on the aluminium containing layer, the apparatus comprising means to directly illuminate a surface of a component with radiation at a suitable wavelength to produce excitation of electrons from a normal energy state to a higher energy state in any alumina on the surface of the component, means to detect radiation emitted at a particular wavelength by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component, means to analyse the radiation emitted by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component to determine the thickness of the alumina at at least one point on the surface of the component and means to compare the determined thickness of the alumina at the at least one point on the surface of the component with a predetermined thickness of alumina at that point on the surface of the component to decide if the thickness of alumina at the at least one point on the surface of the component is satisfactory.

17. An apparatus as claimed in claim 16 wherein the means to illuminate the surface of the component is arranged to illuminate the surface of the component with ultraviolet radiation, radiation in the blue region and/or radiation in the green region of the radiation spectrum.

18. An apparatus as claimed in claim 16 wherein the means to illuminate the surface of the component is arranged to illuminate the surface of the component with radiation at wavelength selected from the group consisting of 488 nm, 505 nm, 514 nm and 530 nm.

19. An apparatus as claimed in claim 16 wherein the means to detect radiation is arranged to detect radiation at a wavelength in the range of 692 nm to 696 nm.

20. An apparatus as claimed in claim 16 wherein the means to illuminate the surface of the component with radiation is selected from the group consisting of at least one light emitting diode and at least one laser.

21. An apparatus as claimed in claim 16 wherein the means to detect radiation comprises a camera.

22. An apparatus as claimed in claim 20 wherein the means to illuminate the surface of the component comprises a plurality of light emitting diodes arranged in an array around a camera.

23. An apparatus as claimed in claim 21 wherein the camera has a red band-pass filter.

24. An apparatus as claimed in claim 20 wherein the at least one light emitting diode has a filter, the filter is selected from the consisting of a green short-pass filter, a blue filter, an ultraviolet filter and a short pass filter which blocks red light.

25. An apparatus as claimed in claim 16 wherein the apparatus comprises a radiation tight enclosure and the means to illuminate the surface of the component is arranged to illuminate an external surface of the component and the means to illuminate the surface of the component and the means to detect radiation are arranged in the light tight enclosure.

26. An apparatus as claimed in claim 16 wherein the apparatus comprises a boroscope to illuminate an internal surface of the component.

27. A method of determining the presence of an alumina layer on a surface of a component, an aluminum containing layer being arranged on the surface of the component and an alumina layer being arranged on the aluminum containing layer, the method comprising:

a) directly illuminating a surface of a component with radiation at a suitable wavelength to produce excitation of electrons from a normal energy state to a higher energy state in any alumina on the surface of the component, directly illuminating the surface of the component using an array of light emitting diodes or lasers to inspect the whole of the surface of the component,

b) detecting radiation emitted at a particular wavelength by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component, the detecting comprising taking a still image of the surface of the component,

c) analyzing the radiation emitted by electrons reverting from the higher energy state to the normal energy state in any alumina on the surface of the component to determine the thickness of the alumina at each point on the surface of the component, the analyzing comprising analyzing the still image of the surface of the component, and

d) comparing the determined thickness of the alumina at each point on the surface of the component with a predetermined thickness of alumina at that point on the surface of the component to decide if the thickness of alumina at each point on the surface of the component is satisfactory and hence an aluminum containing layer is present on the surface of the component.