

PILOT UNIT

FIELD OF THE INVENTION

The field of the invention relates to a pilot unit for an abatement apparatus and a method.

BACKGROUND

5 Abatement apparatus, such as radiant burners, are known and are typically used for treating an effluent gas stream from a manufacturing processing tool used in, for example, the semiconductor or flat panel display manufacturing industry. During such manufacturing, residual perfluorinated compounds (PFCs) and other compounds exist in the effluent gas stream pumped from the process tool. PFCs are difficult to remove from
10 the effluent gas and their release into the environment is undesirable because they are known to have relatively high greenhouse activity.

Known radiant burners use combustion to remove the PFCs and other compounds from the effluent gas stream, such as that described in EP 0 694 735. Typically, the effluent gas stream is a nitrogen stream containing PFCs and other compounds. The effluent
15 stream is conveyed into a combustion chamber that is laterally surrounded by the exit surface of a foraminous gas burner. In some cases treatment materials, such as fuel gas, can be mixed with the effluent gas stream before entering the combustion chamber. Fuel gas and air are simultaneously supplied to the foraminous burner to affect combustion at the exit surface. The products of combustion from the foraminous burner react with the
20 effluent stream mixture to combust compounds in the effluent stream.

Although techniques exist for igniting abatement apparatus, they each have their own shortcomings. Accordingly, it is desired to provide an improved technique for igniting an abatement apparatus.

SUMMARY

25 According to a first aspect, there is provided a pilot unit for an abatement apparatus

configured to abate an effluent stream from a semiconductor processing tool, the pilot unit comprising: a housing retaining a foraminous pilot surface, the housing and foraminous pilot surface defining a plenum which is configured to convey fuel and oxidant from a corresponding housing inlet and through that foraminous pilot surface; and
5 an ignitor configured to ignite the fuel and oxidant when exiting the foraminous pilot surface.

The first aspect recognizes that a problem with some abatement apparatus is that the ignition event of the combustion chamber may be harsh and/or cause an ignition shock often due to an over-accumulation of uncombusted fuel and oxidant which then ignites.
10 This can cause an abrupt expansion of gases within the abatement apparatus which can impact the reliability of the apparatus, delay ignition and even extinguish the pilot. A pilot designed to light multiple burners can magnify this problem because the pilot flame needs to spread out over a larger area to reach each burner. Accordingly, a pilot unit, device or assembly is provided. The pilot unit may be for an abatement apparatus which
15 abates an effluent stream from a semiconductor processing tool. The pilot unit may comprise a housing or enclosure. The housing may retain or provide a foraminous pilot surface. A plenum may be defined by the housing and the foraminous pilot surface. The plenum may be arranged or configured to convey fuel and oxidant between a housing inlet and the foraminous pilot surface. The pilot unit may comprise an igniter which is
20 arranged to ignite the fuel and oxidant exiting or being discharged from the foraminous pilot surface. In this way, rather than having an ignition flame combusting from a nozzle, an ignition flame is provided across the foraminous pilot surface which provides for a softer and faster ignition event which can light multiple burners and improves the reliability of the abatement apparatus.
25 The foraminous pilot surface may be positioned on an external surface of the housing.

The foraminous pilot surface may be positioned on an outer or outward-facing surface of the housing.

The foraminous pilot surface may be shaped or configured to fit or be located proximate or adjacent a burner of the abatement apparatus. This enables the ignition flame provided
5 by the foraminous pilot surface to ignite combustion materials present in the burner.

The foraminous pilot surface may be shaped or configured to fit or be located proximate or adjacent at least one of a plurality of burners of the abatement apparatus. Accordingly, a single pilot unit may be used to ignite more than one burner, rather than requiring a separate pilot for each burner. Also, locating the pilot surface outside of the burners
10 reduces interference with internal conditions within the burners.

The foraminous pilot surface may be shaped or configured to abut one or more of the plurality of burners of the abatement apparatus. This assists in spreading the ignition flame from the pilot unit to those burners.

The foraminous pilot surface may be shaped or configured to abut a combustion surface
15 of at least one of the plurality of burners of the abatement apparatus.

The foraminous pilot surface may be shaped to provide a continuation of a combustion surface of at least one of the plurality of burners of the abatement apparatus.

The foraminous pilot surface may be shaped to extend along an edge of at least one of the plurality of burners of the abatement apparatus.

20 The foraminous pilot surface may be shaped to extend along at least a portion of a perimeter of at least one of the plurality of burners of the abatement apparatus.

The pilot unit may be configured to locate the foraminous pilot surface to ignite fuel and oxidant exiting at least one of the plurality of burners of the abatement apparatus.

The pilot unit may be configured to locate the foraminous pilot surface towards or near an
25 exhaust of at least one of the plurality of burners of the abatement apparatus.

The foraminous pilot surface may be planar.

The foraminous pilot surface may be elongate.

The foraminous pilot surface may define at least one aperture. The apertures may receive or retain the igniter, a sight port and/or a sensor such as, for example, an ultraviolet,
5 infrared and/or temperature sensor.

The foraminous pilot surface may comprise a plurality of adjacent foraminous pilot surfaces. This enables a foraminous pilot surface to be provided with a shape suited to the requirements for effective ignition.

One of the plurality of adjacent foraminous pilot surfaces may define the at least one
10 aperture.

The housing may comprise a main housing and a removably retained sub-housing. The foraminous pilot surface may be retained by the sub-housing. This provides an arrangement whereby the sub-housing may be removed to enable servicing or replacement of the foraminous pilot surface without disturbing the main housing.

15 The main housing may be formed of a material having a lower use temperature (and therefore a lower melting point) and/or a lower oxidation resistance (and therefore a lower chemical resistance) than a material forming the sub-housing. This enables the larger main housing to be made of a wider range of materials than the sub-housing.

The main housing may define a main plenum and the sub-housing may define a sub-plenum. The sub-plenum may be in fluid communication with the main plenum (which
20 allows the flow of fuel and oxidant from the main plenum into the sub-plenum) to feed the foraminous pilot surface.

The igniter may comprise a nozzle (such as a tubular nozzle) configured to generate a pilot flame to ignite the fuel and oxidant exiting the foraminous pilot surface. This
25 enables the pilot flame to be observed even when it is not possible to observe the pilot

surface. In addition, the igniter may be retained within the nozzle to provide for protection.

The nozzle may be retained within the pilot unit. This helps to protect the nozzle.

The nozzle may comprise a nozzle conduit which extends through the plenum. This
5 enables the fuel and oxidant provided to the igniter to be different to the fuel and oxidant supplied to the foraminous pilot surface.

The pilot unit may comprise a fuel and oxidant manifold which has a plurality of inlets. Each inlet may be configured to receive fuel and/or oxidant and may be configured to deliver that fuel and oxidant to the nozzle and to the plenum in different stoichiometric
10 ratios.

The manifold may be configured to deliver fuel and oxidant to the nozzle with a ratio of fuel to oxidant which is richer compared to the ratio of fuel to oxidant delivered to the plenum.

The fuel and oxidant manifold may comprise one or more mixers which are configured to
15 vary or adjust a mix of the fuel and oxidant to the nozzle and/or the plenum.

The housing may comprise a plurality of upstands which extend to at least the foraminous pilot surface. These upstands help to protect the foraminous pilot surface during assembly of the abatement apparatus.

According to a second aspect, there is provided an abatement apparatus comprising the
20 pilot unit of the first aspect.

The abatement apparatus may comprise the features of the pilot unit set out above.

According to a third aspect, there is provided a method, comprising: retaining a foraminous pilot surface in a housing to define a plenum; conveying fuel and oxidant from a corresponding housing inlet, through the plenum to the foraminous pilot surface;
25 and igniting the fuel and oxidant when exiting the foraminous pilot surface.

The method may comprise positioning the foraminous pilot surface on an external surface of the housing.

The method may comprise positioning the foraminous pilot surface on an outer surface of the housing.

- 5 The method may comprise shaping the foraminous pilot surface to fit proximate a burner of the abatement apparatus.

The method may comprise shaping the foraminous pilot surface to fit proximate at least one of a plurality of burners of the abatement apparatus.

- 10 The method may comprise shaping the foraminous pilot surface to abut at least one of the plurality of burners of the abatement apparatus.

The method may comprise shaping the foraminous pilot surface to abut a combustion surface of at least one of the plurality of burners of the abatement apparatus.

- 15 The method may comprise shaping the foraminous pilot surface to provide a continuation of a combustion surface of at least one of the plurality of burners of the abatement apparatus.

The method may comprise shaping the foraminous pilot surface to extend along an edge of at least one of the plurality of burners of the abatement apparatus.

- 20 The method may comprise shaping the foraminous pilot surface to extend along at least a portion of a perimeter of at least one of the plurality of burners of the abatement apparatus.

The method may comprise locating the foraminous pilot surface to ignite fuel and oxidant exiting at least one of the plurality of burners of the abatement apparatus.

The method may comprise locating the foraminous pilot surface towards an exhaust of at least one of the plurality of burners of the abatement apparatus.

- 25 The foraminous pilot surface may be planar.

The foraminous pilot surface may be elongate.

The method may comprise defining at least one aperture in the foraminous pilot surface to receive at least one of the ignitor, a sight port and a sensor.

The method may comprise forming the foraminous pilot surface from a plurality of
5 adjacent foraminous pilot surfaces.

The method may comprise defining the at least one aperture in one of the plurality of adjacent foraminous pilot surfaces.

The method may comprise forming the housing from a main housing and a removably retained sub-housing and retaining the foraminous pilot surface using the sub-housing.

10 The method may comprise forming the main housing of material having at least one of a lower use temperature and lower oxidation resistance than material forming the sub-housing.

The method may comprise defining a main plenum with the main housing and a sub-plenum with the sub-housing, and arranging the sub-plenum for fluid communication
15 with the main plenum.

The method may comprise providing a nozzle as the ignitor and generating a pilot flame with the nozzle to ignite the fuel and oxidant exiting the foraminous pilot surface.

The method may comprise retaining the nozzle within the pilot unit.

The method may comprise providing a nozzle conduit extending through the plenum as
20 the nozzle.

The method may comprise providing a fuel and oxidant manifold having a plurality of inlets, receiving a respective one of the fuel and oxidant at each inlet and delivering the fuel and oxidant to the nozzle and the plenum in different stoichiometric ratios.

The method may comprise delivering the fuel and oxidant to the nozzle with a richer ratio
25 of fuel to oxidant compared to fuel to oxidant delivered to the plenum.

The method may comprise varying a flow of the fuel and oxidant to at least one of the nozzle and the plenum with at least one flow adjuster.

The method may comprise forming the housing with a plurality of upstands configured to extend to at least the foraminous pilot surface.

- 5 Further particular and preferred aspects are set out in the accompanying independent and dependent claims. Features of the dependent claims may be combined with features of the independent claims as appropriate, and in combinations other than those explicitly set out in the claims.

Where an apparatus feature is described as being operable to provide a function, it will be
10 appreciated that this includes an apparatus feature which provides that function or which is adapted or configured to provide that function.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described further, with reference to the accompanying drawings, in which:

- 15 FIG. 1A is a perspective view of components of a modular abatement apparatus according to one embodiment;

FIG. 1B is a sectional view through FIG. 1A providing a sectional view of a pilot module
20;

- FIG. 1C is a cross-sectional view through FIG. 1A providing a sectional view of
20 combustion chamber modules;

FIG. 2 is a view from downstream of the combustion chamber modules;

FIGS. 3A and 3B show the arrangement of the combustion chamber modules and the pilot module in more detail, with the housing removed;

FIG. 4 illustrates a pilot module according to one embodiment - FIG. 4A is a top view,

- 25 FIG. 4B is a sectional view along section A-A, FIG. 4C is a downstream view and FIG.

4D is a perspective view;

FIG. 5 shows a pilot module according to one embodiment - FIG. 5A is a top view, FIG. 5B is a sectional view along section B-B, FIG. 5C is a downstream view and FIG. 4D is a perspective view; and

5 FIG. 6 illustrates the manifold shown in FIG. 5 in more detail.

DESCRIPTION OF THE EMBODIMENTS

Before discussing the embodiments in any more detail, first an overview will be provided. Some embodiments provide a pilot unit. The pilot unit is typically used to ignite a combustion chamber of an abatement apparatus which abates an effluent stream from a semiconductor processing tool. The pilot unit provides a foraminous pilot surface which is ignited to act as the pilot for the abatement apparatus. This arrangement provides for reliable ignition of the combustion chambers since the foraminous pilot surface can vary in shape to fit a variety of combustion chamber geometries, as well as igniting multiple combustion chambers. In particular, the foraminous pilot surface may be arranged to provide effectively a continuation of the combustion surfaces of the burners to enable reliable ignition of those burners. In addition, the pilot unit is typically located outside of the combustion chamber which reduces interference with processes within the combustion chamber and removes the pilot unit from that harsh environment. In some embodiments, the pilot unit is formed of two housings, one of which interfaces with the fuel and oxidant supply of the abatement apparatus and the other of which provides the foraminous pilot surface. This enables the foraminous pilot surface portion to easily be removed for maintenance and enables the main housing to be made from a wider range of materials. In some embodiments, an igniter in the form of a nozzle is used to generate a pilot flame to cause ignition on the foraminous pilot surface. A manifold is typically provided which provides differing stoichiometric ratios of fuel and oxidant supplied to the

igniter and to the foraminous pilot surface.

Abatement Apparatus

FIG. 1A is a perspective view of components of a modular abatement apparatus 10 according to one embodiment. FIG. 1B is a sectional view through FIG. 1A providing a
5 sectional view of a pilot module 20. FIG. 1C is a cross-sectional view through FIG. 1A providing a sectional view of the combustion chamber modules 30. FIG. 1D is sectional view showing the combustion chamber modules 30 in more detail.

A housing 40 is provided which defines a common housing chamber within which combustion chamber modules 30 are provided. A common headplate 150 is provided
10 which covers an upstream opening of the housing 40. As can be seen in FIG. 2A, the headplate 150 receives effluent stream inlets 60 for supplying an effluent stream, treatment material inlets 70 for supplying treatment materials such as fuel, a pilot module inlet 110 for supplying fuel and a purge inlet 160 for supplying an inter-module purge gas such as nitrogen. Downstream of the housing 40 is a weir 170 which defines a wetted
15 wall chamber 180 which in operation has walls over which a fluid such as water flows. In this example, there are two combustion chamber modules 30 arranged linearly within the housing 40, however as will be explained in more detail below, different configurations and numbers of combustion chamber modules 30 are possible which share a common housing and common headplate.

20 Between the headplate 150 and the combustion chamber modules 30 is provided a mount 50 which retains the combustion chamber modules 30 in place within the housing 40. The depth of this mount 50 can vary to accommodate different length combustion chamber modules 30 while still ensuring that each combustion chamber modules 30 discharges at the same position into the weir 170.

25 The combustion chamber module 30 has a module housing 80 within which is fitted a

foraminous sleeve 90. The foraminous sleeve 90 defines a combustion chamber 120 within which the supplied effluent stream is treated. Each combustion chamber module 30 is provided with an effluent stream inlet 60 which conveys an effluent stream to be treated into the combustion chamber of that combustion chamber module 30. The
5 foraminous sleeve 90 is spaced away slightly from the module housing 80 to define a plenum 100. Treatment material inlets 70 convey treatment materials such as fuel through the mount 50 and into the plenum 100 of the respective combustion chamber module 30. Hence, each combustion chamber module 30 is essentially self-contained and its operation has no effect on other combustion chamber modules 30 within the
10 housing 40.

FIG. 2B shows a view from downstream of the combustion chamber modules 30. As can also be seen also be seen in FIG. 1D, the foraminous sleeve 90 has a planar upstream ceiling 200 from which depends four diverging walls 180 which terminate with a rounded shoulder 140 at a discharge end of the combustion chamber 120. This forms a
15 combustion chamber 120 having a generally trapezoidal configuration. The pilot module 20 has a downstream discharge surface 130 which abuts the shoulder 140 of the foraminous sleeves 90.

FIGS. 3A and 3B show the arrangement of the combustion chamber modules 30 and the pilot module 20 in more detail, with the housing 40 removed. In this example, the
20 combustion chamber modules 30 are of equal length and so the mounts 50 are of equal height. In order to protect the shoulders 140 and the discharge surface 130 from damage during assembly, they are provided with protrusions 190 which allow the combustion chamber modules 30 and the pilot module 20 to be placed on a surface without contacting the shoulders 140 and the discharge surface 130.

25 Pilot Module

FIG. 4 illustrates a pilot module 20A according to one embodiment. FIG. 4A is a top view, FIG. 4B is a sectional view along section A-A, FIG. 4C is a downstream view and FIG. 4D is a perspective view. The pilot module 20A comprises a main housing 300 and a sub-housing 310. The pilot module 20 is shaped to interface with or abut against the combustion chamber modules 30. In this example, the pilot module 20A is an elongate cuboid, but it will be appreciated that other shapes are possible, depending on the number and shape of the combustion chamber modules 30. The main housing 300 has an upstream face 320 and a downstream face 330. Sidewalls 340 extend between the upstream face 320 and the downstream face 330. The sub-housing 310 has an upstream face 350. Sidewalls 360 depend from the upstream face 350. A foraminous pilot surface 370 is located in a downstream opening defined by the sidewalls 360 and provides a discharge surface 130A. A fuel and air inlet 380 is provided in the upstream face 320. In operation, fuel and air is provided through the inlet 380 which is conveyed into a plenum 390 within the main housing 300. Fuel and air then flow through the downstream face 330 and the upstream face 350 from the plenum 390 to a plenum 400 within the sub-housing 310. Fuel and air then pass through the foraminous pilot surface 370 for combustion on the discharge surface 130.

An igniter 410 extends from the upstream face 320, through the plenums 390, 400 to an ignition aperture 420 in the foraminous pilot surface 370. The igniter 410 comprises a central conductor 430 housed within a tubular conduit 440. An inlet 450 receives fuel and air and is in fluid communication with the conduit 440. In operation, fuel and air is supplied via the inlet 450 and passes around the conductor 430 through the conduit 440 and discharges through the ignition aperture 420. A voltage is applied to the conductor 430 which causes an electrical discharge which ignites the fuel and air mixture exiting the ignition aperture 420 which, in turn, ignites the fuel and air exiting the discharge surface

130. This causes combustion over the complete discharge surface 130, which causes fuel and air passing through the foraminous sleeves 90 of the adjacent combustion chamber modules 30 to also ignite.

A sight tube 460 extends from the upstream face 320, through the plenums 390, 400 and
5 through a sight aperture 470.

The sub-housing 310 is closer to the discharge of the combustion chambers 120 and so are made of a material which is typically of a higher melting point and more resistant to chemical attack than the main housing 300. Also, the sub-housing 310 can be removed to either replace the complete sub-housing 310 and/or the foraminous pilot surface 370
10 during maintenance. However, the main housing 300 and all of its connectors need not be removed and can remain in place. This speeds up and simplifies maintenance of the pilot module 20A.

FIG. 5 shows a pilot module 20B according to one embodiment. FIG. 5A is a top view, FIG. 5B is a sectional view along section B-B, FIG. 5C is a downstream view and FIG.
15 4D is a perspective view. This embodiment is similar to that shown in FIG. 4, with the exception that a manifold 480 is provided which receives separate feeds and mixes those feeds to provide fuel-air mixes with differing fuel-air ratios. In particular the manifold receives separate feeds of fuel, air or mixes of fuel and air, combines these in two different equivalence ratios and delivers a first fuel and air mix with one equivalence ratio
20 to an igniter 410A and a second fuel and air mix with a different equivalence ratio to the plenum 390A via the inlet 380A, as illustrated in more detail in FIG. 6 below. As can be seen, a lean inlet 490 is provided which receives the first fuel and air mix in a fuel-lean ratio to be conveyed via the inlet 380A which feeds the plenum 390A. In addition, a fuel inlet 500 is provided which supplies additional fuel to the manifold 480. The first fuel
25 and air mix supplied to the lean inlet 490 mixes with additional fuel supplied through the

fuel inlet 500 and increases the ratio of fuel to air present in the second fuel and air mix provided to the igniter 410A. In particular, the first fuel and air mix in the fuel-lean ratio passes through an aperture 505 having a dimension set to control the amount of the first fuel and air mix being mixed with the additional fuel from the fuel inlet 500 in order to
5 create the second fuel and air mixt in the correct ratio for supply to the igniter 410A. It will be appreciated that typically the first fuel and air mix provided to the plenum 390A via the inlet 380A is at a sub-stoichiometric ratio and the second fuel and air mixt provided to the igniter 410A is at a stoichiometric ratio. Although in this example a lean fuel air mixture is provided together with additional fuel, it will be appreciated that this
10 need not be the case and that a fuel and air mix together with an oxidant may be provided or, as mentioned above, separate fuel and air may be provided which can be mixed within the manifold as required to provide the desired fuel to air ratios for the plenum 390A and for the igniter 410A.

Returning now to FIG. 5, as can be seen, the sub-housing 310A is formed of two parts, a
15 first part 510 which has no apertures and a second part 520 which has the aperture for the igniter 410A. Providing separate parts again assists in maintenance, since either part may be replaced independently of the other. As can also be seen, similar to the arrangement shown in FIG. 4, elongate bolts 405A are provided through the upstream surface of the main housing 300A to connect the main housing 300 to the sub-housing 310A.

20 Hence, it can be seen that some embodiments provide a pilot burner with a jet pilot integrated into a surface burner. This allows for a modular pilot burner that has a fully purged combustion chamber interface. The surface burner portion can vary in shape to ignite multiple main burners and fit a variety of combustion chamber geometries. The jet pilot portion provides ignition, a strong flame signal, and a visual indication that the
25 flame is lit.

In some embodiments, fuel and air are introduced to inlets. One Inlet feeds to the surface burner portion and one inlet feeds to the jet pilot portion. The fuel and air provided to the inlets are in fluid communication so that jet and surface burners are working in unison. From one inlet the fuel and air mixture travels down the pilot tube which is integrated into
5 main plenum. The electrode extends down the centre of the pilot tube terminating near the end. This electrode will provide the ignition source via high voltage spark and the flame sensing via flame ionization. Near the end of pilot tube there is a flow obstruction that provides flow turbulence and flame arresting. This flow obstruction is supported by the electrode. The fuel and air mixture travels through the flow obstruction and combusts
10 on the other side. The products of combustion create a flame jet that extends into the combustion chamber. The sight tube allows for a view of the flame from the outside of the combustion chamber. From the other inlet, the fuel and air mixture travels through the main plenum and into the secondary plenum. Attached to secondary plenum is the permeable or foraminous burner material. The secondary plenum allows for cost
15 effective replacement of the foraminous burner material by detaching the secondary plenum from the main plenum. The fuel and air mixture travels through the burner material and combusts in the combustion chamber. Functionally, the fuel and air is introduced to the inlets. The electrode creates a spark to first ignite a flame at the end of pilot tube. This flame propagates and stabilizes along the surface of the foraminous
20 burner material. The result is a stable pilot system which can vary in shape and proportion.

Some embodiments provide a traditional jet-style pilot burner integrated with surface burner, fed from the same fuel/air supply. There is a fully purged interface between burner and combustion chamber which reduces solid deposition. The inclusion of the
25 surface burner enables variation of geometry, to enable tessellation of the pilot burner

surface with the other burner modules in a modular assembly. The surface burner shape can vary. Standoffs at the base of the burner can be included to prevent damage to the surface burner section. The surface burner material can be a removable part from the main assembly for cost effective repairs. An excess fuel connection can be added so that

5 the jet pilot is richer than the surface burner. A needle valve can be included at the fuel/air inlet to adjust jet pilot firing rate in relation to surface burner firing rate. The surface burner can be split into two distinct elements. One element would have penetrations for the jet pilot, sight port, and thermocouple, the other element has no penetrations.

10 Although illustrative embodiments of the invention have been disclosed in detail herein, with reference to the accompanying drawings, it is understood that the invention is not limited to the precise embodiment and that various changes and modifications can be effected therein by one skilled in the art without departing from the scope of the invention as defined by the appended claims and their equivalents.

15 REFERENCE SIGNS

Abatement apparatus 10

Pilot module 20; 20A; 20B

Combustion chamber module 30

Housing 40

20 Mount 50

Effluent stream inlet 60

Treatment material inlet 70

Foraminous sleeve 90

Pilot module inlet 110

25 Combustion chamber 120

	Discharge surface 130
	Purge inlet 160
	Weir 170
	Walls 180
5	Protrusions 190
	Ceiling 200
	Main housing 300; 300A
	Sub housing 310; 310A
	Upstream face 320; 350
10	Downstream face 330
	Sidewalls 340; 360
	Foraminous pilot surface 370
	Inlet 380; 450
	Plenum 390; 400
15	Bolts 405A
	Ignitor 410
	Ignition aperture 420
	Conductor 430
	Conduit 440
20	Sight tube 460
	Sight aperture 470
	Manifold 480
	Lean inlet 490
	Fuel inlet 500
25	Aperture 505

First part 510

Second part 520

CLAIMS

1. A pilot unit for an abatement apparatus configured to abate an effluent stream from a semiconductor processing tool, said pilot unit comprising:
 - a housing retaining a foraminous pilot surface, said housing and foraminous pilot
 - 5 surface defining a plenum which is configured to convey fuel and oxidant from a corresponding housing inlet and through that foraminous pilot surface; and
 - an ignitor configured to ignite said fuel and oxidant when exiting said foraminous pilot surface.
2. The pilot unit of claim 1, wherein said foraminous pilot surface is positioned on
- 10 one of an external and an outer surface of said housing.
3. The pilot unit of claim 1 or 2, wherein said foraminous pilot surface is shaped to fit proximate a burner of said abatement apparatus.
4. The pilot unit of any preceding claim, wherein said foraminous pilot surface is shaped to fit proximate at least one of a plurality of burners of said abatement apparatus.
- 15 5. The pilot unit of claim 4, wherein said foraminous pilot surface is at least one of:
 - shaped to abut at least one of said plurality of burners of said abatement apparatus;
 - shaped to abut a combustion surface of at least one of said plurality of burners of said abatement apparatus;
 - shaped to provide a continuation of a combustion surface of at least one of said
 - 20 plurality of burners of said abatement apparatus;
 - shaped to extend along an edge of at least one of said plurality of burners of said abatement apparatus; and
 - shaped to extend along at least a portion of a perimeter of at least one of said plurality of burners of said abatement apparatus.
- 25 6. The pilot unit of claim 4 or 5, wherein said pilot unit is at least one of:

configured to locate said foraminous pilot surface to ignite fuel and oxidant exiting at least one of said plurality of burners of said abatement apparatus; and

configured to locate said foraminous pilot surface towards an exhaust of at least one of said plurality of burners of said abatement apparatus.

- 5 7. The pilot unit of any preceding claim, wherein said foraminous pilot surface is at least one of planar and elongate.
8. The pilot unit of any preceding claim, wherein said foraminous pilot surface defines at least one aperture to receive at least one of said ignitor, a sight port and a sensor.
- 10 9. The pilot unit of any preceding claim, wherein said foraminous pilot surface comprises a plurality of adjacent foraminous pilot surfaces.
10. The pilot unit of claim 9, wherein one of said plurality of adjacent foraminous pilot surfaces defines said at least one aperture.
11. The pilot unit of any preceding claim, wherein said housing comprises a main
15 housing and a removably retained sub-housing, said foraminous pilot surface by retained by said sub-housing.
12. The pilot unit of claim 11, wherein said main housing is formed of material having at least one of a lower use temperature and lower oxidation resistance than material forming said sub-housing.
- 20 13. The pilot unit of claim 11 or 12, wherein said main housing defines a main plenum and said sub-housing defines a sub-plenum, said sub-plenum being in fluid communication with said main plenum.
14. The pilot unit of any preceding claim, wherein said ignitor comprises a nozzle configured to generate a pilot flame to ignite said fuel and oxidant exiting said
25 foraminous pilot surface.

15. The pilot unit of claim 14, wherein said nozzle is retained within said pilot unit.
16. The pilot unit of claim 14 or 15, wherein said nozzle comprises a nozzle conduit extending through said plenum.
17. The pilot unit of any one of claims 14 to 16, comprising a fuel and oxidant
5 manifold having a plurality of inlets, each inlet being configured to receive at least one of said fuel and oxidant and configured to deliver said fuel and oxidant to said nozzle and said plenum in different stoichiometric ratios.
18. The pilot unit of claim 17, wherein said manifold delivers said fuel and oxidant to said nozzle with a richer ratio of fuel to oxidant compared to fuel to oxidant delivered to
10 said plenum.
19. The pilot unit of claim 17 or 18, wherein said manifold comprises at least one flow mixer configured to vary a mix of said fuel and oxidant to at least one of said nozzle and said plenum.
20. The pilot unit of any preceding claim, wherein said housing comprises a plurality
15 of upstands configured to extend to at least said foraminous pilot surface.
21. An abatement apparatus comprising the pilot unit of any preceding claim.
22. A method, comprising:
retaining a foraminous pilot surface in a housing to define a plenum;
conveying fuel and oxidant from a corresponding housing inlet, through said plenum to
20 said foraminous pilot surface; and
igniting said fuel and oxidant when exiting said foraminous pilot surface.