a side of the gas inlet chamber 114 and penetrates through the first outer wall 111, the first inner wall 112 and the first cooling chamber 113 to communicate with the gas inlet chamber 114. The at least one guide conduit 116 is configured to introduce an effluent stream 50 into the gas inlet chamber 114. The gas inlet chamber 114 extends along a vertical Z axis, and an insertion direction of the at least one guide conduit 116 in the gas inlet chamber 114 is not parallel to the Z axis. In this embodiment, the insertion direction intersects the Z axis at an angle, and the angle is preferably between 45° and 90°. In this embodiment, the at least one guide conduit 116 comprises a first section 1161, a second section 1162, and a curved section 1163. The curved section 1163 is mounted between the first section 1161 and the second section 1162. The curved section 1163 is configured to buffer a speed of the effluent stream 50 from the first section 1161 to the second section 1162 through the curved section 1163 and from the second section 1162 into the gas inlet chamber 114. In the invention, the Z axis is substantially orthogonal to an installation plane (that is, the XY plane) of the apparatus. In other words, the Z axis and a normal vector of the installation plane overlap or intersect by a small angle.

The reaction unit 12 comprises a second outer wall 121, a second inner wall 122, a second cooling chamber 123, a reaction chamber 124, an upper opening 125, and a lower opening 126. The second cooling chamber 123 is defined between the second outer wall 121 and the second inner wall 122, the second cooling chamber 123 is a

cooling chamber 123 of the reaction unit 12. The third pipe 143 comprises a first end 143a and a second end 143b, the first end 143a is connected to another side of the first cooling chamber 113, and the second end 143b is connected to a cooling water outlet or a cooling loop. As shown in FIG. 5, a cooling water enters the second cooling chamber 123 from the first pipe 141, enters the first cooling chamber 113 through the second pipe 142, and leaves from the third pipe 143. In this embodiment, the first cooling chamber 113, the second cooling chamber 123 and the second pipe 142 are configured to form a three-dimensional annular water jacket enclosing the gas inlet chamber 114 and the reaction chamber 124 to provide sufficient cooling effect.

The combustion unit provides an active flame, referring to FIG. 2A and FIG. 3, the combustion unit comprises a plurality of combustion assemblies 15a, 15b, 15c, 15d, referring to FIG. 7, in this embodiment, the plurality of combustion assemblies 15a, 15b, 15c, 15d are symmetrically mounted around the reaction chamber 124. Referring to FIG. 6, taking the combustion assembly 15a as an example, the combustion assembly 15a comprises a housing 151a, an inner tube 152a, an ignition plug 153a, a first duct 154a, a second duct 155a, and a plurality of connectors 156a, 157a, 158a. The inner tube 152a is disposed in the housing 151a. The inner tube 152a comprises a head end 1521a, a tail end 1522a, a first side end 1523a and a second side end 1524a. The head end 1521a is connected to the reaction chamber 124 via the connector 156a, the tail end 1522a is

connected to the second duct 155a via the connector 158a, the second side end 1524a is connected to the first duct 154a via the connector 157a, and the first side end 1523a is connected to the ignition plug 153a. The first duct 154a is used to deliver an oxidant to the inner tube 152a. The oxidant may be oxygen, ozone, air, compressed air (CDA), oxygen-enriched air or a mixture thereof. The second duct 155a is used to deliver a fuel gas to the inner tube 152a. The fuel gas may be hydrogen, methane, natural gas, propane, liquefied petroleum gas (LPG) or a mixture thereof. The inner tube 152a may be regarded as a pre-mixing section. The oxidant and the fuel gas are mixed in the inner tube 152a. The ignition plug 153a is configured to generate a spark to the inner tube 152a, in this way, a pilot flame is provided near the connector 156a adjacent to the head end 1521a. In addition, as shown in FIG. 3, the apparatus further comprises a gas assembly 60, and the gas assembly 60 controls delivery of gas or fuel of the first duct 154a and the second duct 155a.

Referring to FIG. 3, in this embodiment, the connector 156a penetrates the second outer wall 121 and the second inner wall 122 of the reaction unit 12. Please refer to FIG. 4, the connector 156a of the combustion assembly 15a and the upper opening 125 of the reaction unit 12 are spaced by a distance H1 between 50mm and 55mm, and the connector 156a of the combustion assembly 15a and the lower opening 126 of the reaction unit 12 are spaced by a distance H2 between 330mm and 350mm. The above dimensions are for reference only. According to different applications, these dimensions

may have different values.

In addition, in this embodiment, in order to avoid insufficient combustion of the pilot flame due to the less oxidant provided by the first duct 154a, referring to FIG. 8, the combustion unit further comprises at least one of third ducts 159a, 159b, 159c, 159d, 159e. The third ducts 159a, 159b, 159c, 159d communicate with the reaction chamber 124 and are located below the combustion assemblies 15a, 15b, 15c, 15d. The third ducts 159a, 159b, 159c, 159d provide more of the oxidant to the reaction chamber 124 to ensure the combustion of a combustion flame. In other embodiments, the ignition plug 153a may be mounted outside the housing 151a, such as disposing in the reaction chamber 124.

The combustion unit generates a flame wall in the reaction chamber 124, which leads to a temperature inside the reaction chamber 124 higher than 900°C. In one embodiment, when a temperature of cooling water is between 16°C and 20°C (for example, 18°C), even if the temperature inside the reaction chamber 124 is higher than 900°C, the temperature outside the second outer wall 121 of the reaction unit 12 is lower than 50°C, thereby safety of operators and operating environment is greatly improved. In contrast, for combustion-type waste gas treatment apparatus without the cooling unit 14, when the temperature inside the reaction chamber 124is higher than 900°C, the temperature outside the second outer wall 121 is also high.

Referring to FIG. 2B again, the exhaust portion 20 is a passage

exhaust portion 20 has a length L1 between 990 mm and 1010 mm, and a distance L2 from a center of the reaction portion 10 to a side end of the exhaust portion 20 is between 690 mm and 710 mm. The connecting section 22 has a height H4 between 380 mm and 400 mm, and the vertical section 23 has a height H5 between 790 mm and 810 mm. The above dimensions are for reference only. According to different applications, these dimensions may have different values.

Referring to FIG. 2B, during operation, the effluent stream 50 enters the gas inlet chamber 114 from the at least one guide conduit 116, and then downwardly flows to the reaction chamber 124 of the reaction unit 12. The combustion assemblies 15a, 15b, 15c, 15d of the combustion unit provide the flame wall in the reaction chamber 124. After the effluent stream 50 is burned by the flame wall with high temperature, the effluent stream 50 will be oxidized or decomposed to reduce or remove toxic substances in the effluent stream 50. The head end 1521a of the inner tube 152a of the combustion assembly 15a and the lower opening 126 of the reaction unit 12 are separated by a first height that facilitates to prolong a flowing time of the effluent stream 50 in the reaction chamber 124, and in one embodiment, the first height is between 330 mm and 350 mm.

The top gas inlet 211 of the transverse section 21 of the exhaust portion 20 receives the effluent stream 50 flowing downward through the reaction unit 12, and the downwardly flowing effluent stream 50 is driven by the transverse gas flow 51 to form a cyclone 52 that

What is Claimed is:

1. An apparatus for treatment of gaseous pollutants comprising:

a reaction portion, comprising:

a gas inlet unit, comprising a first outer wall, a first inner wall, a first cooling chamber, a gas inlet chamber, and at least one guide conduit, the first cooling chamber mounted between the first outer wall and the first inner wall, the first inner wall defining the gas inlet chamber, the at least one guide conduit mounted on a side of the gas inlet chamber and introducing an effluent stream from a semiconductor manufacturing process to the gas inlet chamber;

a reaction unit, coupled below the gas inlet unit, comprising a second outer wall, a second inner wall, a second cooling chamber and a reaction chamber, the second cooling chamber being defined between the second outer wall and the second inner wall, the second inner wall defining the reaction chamber, the reaction chamber and the gas inlet chamber communicating with each other to receive the effluent stream from the gas inlet chamber;

a combustion unit, comprising at least one combustion assembly which comprises a pre-mixing section, an ignition plug, a first duct and a second duct, the first duct and the second duct are configured to introduce an oxidant and a fuel gas to the pre-mixing section, respectively, the ignition plug mounted adjacent to an opening end of the pre-mixing

section, the opening end connected to the reaction chamber, the ignition plug is configured to generate a spark for igniting the oxidant and the fuel gas to provide a pilot flame to the reaction chamber through the opening end to burn the effluent stream; and

a cooling unit, comprising a first pipe and a second pipe, the first pipe connected between a cooling source and the second cooling chamber, the second pipe connected between the second cooling chamber and the first cooling chamber, wherein the first cooling chamber and the second cooling chamber communicate with each other via the second pipe; and

a passage connected to the reaction portion, comprising a transverse section, a connecting section and a vertical section, the transverse section substantially parallel to an extension of an installation plane of the apparatus for treatment of gaseous pollutants, the vertical section substantially perpendicular to the installation plane, the transverse section comprising a lateral gas inlet and a top gas inlet communicating with the reaction chamber of the reaction portion, the connecting section connected between the transverse section and the vertical section;

wherein the top gas inlet receives the effluent stream flowing downward through the reaction portion, the lateral gas inlet receives a transverse gas flow, and the effluent stream is driven by the transverse gas flow to form a cyclone that is discharged through the

connecting section and from an outlet of the vertical section opposite to the connecting section.

2. The apparatus as claimed in claim 1, wherein the first cooling chamber is a first annular chamber, and is spaced with the gas inlet chamber.

3. The apparatus as claimed in claim 1, wherein the second cooling chamber is a second annular chamber, and is spaced with the reaction chamber.

4. The apparatus as claimed in claim 1, wherein the at least one combustion assembly comprises a first combustion assembly, a second combustion assembly, a third combustion assembly, and a fourth combustion assembly that are symmetrically mounted around the reaction chamber, and the combustion assemblies provide a combustion flame to the reaction chamber to form a flame wall, respectively.

5. The apparatus as claimed in claim 1, wherein the gas inlet unit, the reaction chamber, and the vertical section of the passage are mounted along a longitudinal extension perpendicular to the installation plane.

6. The apparatus as claimed in claim 1, wherein when the pilot flame burns the effluent stream in the reaction chamber, a temperature inside the reaction chamber is higher than 900°C, and a temperature outside the second outer wall is lower than 50°C.

7. The apparatus as claimed in claim 1, wherein the pre-mixing section of the combustion assembly is connected to the reaction

chamber via the opening end, and the opening end and a lower opening of the reaction portion are separated by a first height that prolongs a flowing time of the effluent stream in the reaction portion.

8. The apparatus as claimed in claim 1, wherein the vertical section has a second height prolonging a flowing time of the effluent stream in the vertical section, so that a temperature of the effluent stream is dropped below 200°C as the effluent stream flows from the reaction chamber to the outlet of the vertical section.

9. The apparatus as claimed in claim 1, wherein the gas inlet chamber, the reaction chamber, and an internal passage of an exhaust portion is formed as a U-shaped passage.

10. An apparatus for treatment of gaseous pollutants comprising:

a reaction portion comprising:

a gas inlet unit, comprising a gas inlet chamber, and at least one guide conduit, the at least one guide conduit mounted on a side of the gas inlet chamber and introducing an effluent stream from a semiconductor manufacturing process to the gas inlet chamber;

a reaction unit coupled below the gas inlet unit, comprising a reaction chamber, the reaction chamber and the gas inlet chamber communicating with each other to receive the effluent stream from the gas inlet chamber, wherein the reaction unit has a first height for prolonging a flowing time of the effluent stream in the reaction chamber; and

a combustion unit, comprising at least one combustion

assembly which comprises a pre-mixing section, an ignition plug, a first duct and a second duct, the first duct and the second duct are configured to introduce an oxidant and a fuel gas to the pre-mixing section, respectively, the ignition plug mounted adjacent to an opening end of the pre-mixing section, the opening end connected to the reaction chamber, the ignition plug is configured to generate a spark for igniting the oxidant and the fuel gas and to provide a pilot flame to the reaction chamber through the opening end to burn the effluent stream; and

a passage connected to the reaction portion, comprising a transverse section, a connecting section and a vertical section, the transverse section substantially parallel to an installation plane of the apparatus for treatment of gaseous pollutants, the vertical section substantially perpendicular to the installation plane, the transverse section comprising a lateral gas inlet and a top gas inlet communicating with the reaction chamber of the reaction portion, the connecting section connected between the transverse section and the vertical section;

wherein the top gas inlet receives the effluent stream flowing downward through the combustion unit, the lateral gas inlet receives a transverse gas flow, and the effluent stream is driven by the transverse gas flow to form a cyclone that is discharged through the connecting section and from an outlet of the vertical section opposite to the connecting section; and

wherein the vertical section has a second height for prolonging a flowing time of the effluent stream in the vertical section, so that a

temperature of the effluent stream is dropped below 200°C as the effluent stream flows from the reaction chamber to the outlet of the vertical section.

11. The apparatus as claimed in claim 10, wherein the gas inlet unit further comprises a first annular chamber spaced with the gas inlet chamber, the reaction unit further comprises a second annular chamber spaced with the reaction chamber, the first annular chamber and the second annular chamber communicate with each other and are filled with a cooling medium, so that when the pilot flame burns the effluent stream in the reaction chamber, a temperature inside the reaction chamber is higher than 900°C, and a temperature outside the reaction chamber is lower than 50°C.

12. The apparatus as claimed in claim 10, wherein the at least one combustion assembly comprises a first combustion assembly, a second combustion assembly, a third combustion assembly, and a fourth combustion assembly that are symmetrically mounted around the reaction chamber, and the combustion assemblies provide a combustion flame to the reaction chamber to form a flame wall, respectively.

13. The apparatus as claimed in claim 10, wherein the gas inlet unit, the reaction unit, and the vertical section of the passage are mounted along a longitudinal extension perpendicular to the installation plane.

14. The apparatus as claimed in claim 10, wherein the gas inlet chamber, the reaction chamber, and an internal passage of an exhaust portion is formed as a U-shaped passage.