[Claim 1]

A method for fixing carbon dioxide in exhaust gas, the method comprising:

generating a plasma by applying electromagnetic waves using steam or a mixed gas of steam and oxygen as a plasma source gas, and injecting a solid-phase alkali metal hydroxide powder or a liquid-phase alkali metal hydroxide aqueous solution into the plasma to form a plasma catalyst activated in a plasma state; and

fixing carbon dioxide in the exhaust gas by injecting the plasma catalyst into an exhaust gas containing carbon dioxide and reacting the plasma catalyst with the carbon dioxide to form a carbonate or bicarbonate compound.

[Claim 2]

The method of claim 1, wherein the plasma is a microwave plasma torch in which a plasma source gas is injected into a discharge tube penetrating a microwave waveguide to generate a plasma discharge.

[Claim 3]

The method of claim 1, wherein the alkali metal hydroxide is at least one solid or aqueous solution selected from the group consisting of NaOH and KOH.

[Claim 4]

The method of claim 3, wherein the injection of the alkali metal hydroxide is configured to be injected through a carrier gas.

[Claim 5]

The method of claim 4, wherein the carrier gas is steam.

[Claim 6]

The method of claim 1, wherein the plasma source gas further comprises oxygen (O_2).

[Claim 7]

The method of claim 1, wherein the bicarbonate compound or the carbonate compound is at least one selected from the group consisting of $NaHCO_3$, Na_2CO_3, $KHCO_3$, and K_2CO_3.

[Claim 8]

The method of claim 1, wherein the method fixes carbon dioxide contained in a large-volume exhaust gas from a marine engine or the like.

[Claim 9]

A plasma catalyst generating device for capturing carbon dioxide in exhaust gas, the device comprising:

a microwave waveguide configured to transmit microwaves using steam or a mixed gas of steam and oxygen as a plasma source gas;

a quartz discharge tube penetrating the microwave waveguide, the quartz discharge tube comprising a discharge outlet configured to discharge the plasma source gas by the microwave to generate a plasma and to discharge a generated plasma torch;

a discharge gas injection unit configured to inject a plasma source gas, wherein the quartz discharge tube comprises a discharge outlet side on which the discharge outlet is located and a discharge gas injection side opposite to the discharge outlet with the microwave waveguide therebetween, and the discharge gas injection unit is located on the discharge gas injection side; and

an alkali metal hydroxide injection unit located on the discharge outlet side and configured to inject a solid-phase alkali metal hydroxide powder or a liquid-phase alkali metal hydroxide aqueous solution into the plasma using high-pressure steam as a carrier gas.

[Claim 10]

The plasma catalyst generating device of claim 9, wherein the alkali metal hydroxide injection unit comprises a carrier gas injection line and an alkali metal hydroxide injection line branched from the carrier gas injection line, so as to inject the alkali metal hydroxide through a carrier gas.

[Claim 11]

The plasma catalyst generating device of claim 9, further comprising at least one additional gas supply unit configured to supply a gas comprising steam to the plasma through the quartz discharge tube on the discharge outlet side.

[Claim 12]

A device for fixing carbon dioxide in exhaust gas, the device comprising:

an exhaust gas duct through which an exhaust gas containing carbon dioxide passes; and

the plasma catalyst generating device for capturing carbon dioxide in exhaust gas of claim 9,

wherein the discharge outlet penetrates the exhaust gas duct.

[Claim 13]

The device of claim 12, wherein the device comprises two or more plasma catalyst generating devices, and the two or more plasma catalyst generating devices are arranged in a radial pattern so as to discharge a plasma torch toward the center of the exhaust gas duct.

[Claim 14]

The device of claim 12, wherein the device comprises two or more plasma catalyst generating devices, and the plasma catalyst generating devices are arranged diagonally in a sequential and staggered manner along the exhaust gas flow path of the exhaust gas duct.

[Claim 15]

The device of claim 12, wherein the device comprises two or more plasma catalyst generating devices, and the discharge outlet penetrates the exhaust gas duct such that the plasma torch of the plasma catalyst generating device is discharged in a forward diagonal direction of the exhaust gas flow path of the exhaust gas duct.