

What is claimed is:

1. A plasma generating system, comprising:
 - a plasma cavity for generating a plasma therewithin;
 - an adaptor having a gas outlet through which an exhaust gas processed by the plasma exits the plasma cavity, wherein the adaptor is mounted on a bottom side of the plasma cavity and a flow inlet is mounted on a top side of the plasma cavity; and
 - a recuperator directly attached to the adaptor and having a gas passageway that is in fluid communication with the gas outlet in the adaptor, the recuperator being configured to recover heat energy from the exhaust gas and to heat an input gas using the heat energy.
2. A plasma generating system as recited in claim 1, wherein the recuperator has an enclosed space thereinside and one or more baffles that are disposed inside the enclosed space and transfer heat energy to the input gas.
3. A plasma generating system as recited in claim 1, wherein the recuperator has one or more baffles that are disposed in the gas passageway and wherein the one or more baffles recover heat energy from the exhaust gas.
4. A plasma generating system as recited in claim 3, wherein each of the one or more baffles is arranged in parallel to a flow direction of the exhaust gas exiting the gas outlet.
5. A plasma generating system as recited in claim 3, wherein each of the one or more baffles is rifled relative to a flow direction of the exhaust gas exiting the gas outlet.

6. A plasma generating system as recited in claim 1, wherein the recuperator has an enclosed space thereinside, a gas inlet through which the input gas flows into the enclosed space and a gas outlet through the input gas heated using the heat energy exits the enclosed space.

7. A plasma generating system as recited in claim 6, wherein the recuperator has a cap that is in direct contact with a bottom wall of the adaptor and the gas outlet of the recuperator is formed in the cap and wherein the bottom wall of the adaptor has a gas inlet and wherein the gas outlet of the recuperator is aligned with the gas inlet of the adaptor so that the input gas heated in the enclosed space flows into the adaptor through gas outlet of the recuperator and the gas inlet of the adaptor.

8. A plasma generating system as recited in claim 6, further comprising:

the flow inlet configured to introduce the input gas heated by the recuperator into the plasma cavity; and

a pipe having one end coupled to the gas outlet of the recuperator and an other end to the flow inlet, wherein the input gas heated by the recuperator passes through the pipe.

9. A plasma generating system as recited in claim 8, further comprising:

a waveguide for transmitting a microwave energy therethrough; and

an inner wall disposed within the waveguide to define the plasma cavity, a plasma being generated within the plasma cavity using the microwave energy.

10. A plasma generating system as recited in claim 8, wherein the flow inlet introduces the input gas as a vortex flow into the plasma cavity.

11. A plasma generating system as recited in claim 8, further comprising:

a plasma stabilizer having a shape of a circular hollow cylinder and protruding into the plasma cavity, wherein a portion of the flow inlet is disposed inside the plasma stabilizer.

12. A plasma generating system as recited in claim 1, wherein the adaptor is configured to generate a vortex flow within the plasma cavity using the input gas heated by the recuperator.

13. A plasma generating system as recited in claim 12, further comprising:

a plasma stabilizer having a shape of a circular hollow cylinder and disposed on the adaptor, wherein a longitudinal direction of the plasma stabilizer is parallel to a rotational axis of the vortex flow.

14. A plasma generating system as recited in claim 1, wherein the adaptor and the recuperator are formed as one monolithic body.

15. A plasma generating system, comprising:

a waveguide for transmitting a microwave energy therethrough;

an inner wall disposed within the waveguide to define a plasma cavity, a plasma being generated within the plasma cavity using the microwave energy, the waveguide having a gas outlet through which an exhaust gas processed by the plasma exits the plasma cavity;

a recuperator directly attached to the waveguide and having a gas passageway that is in fluid communication with the gas outlet in the waveguide, the recuperator being configured to recover heat energy from the exhaust gas and to heat an input gas using the heat energy;

a gas inlet mounted on the waveguide and configured to receive the input gas from the recuperator and introduce the input gas into the plasma cavity; and

a pipe having one end coupled to the recuperator and an other end coupled to the gas inlet, wherein the input gas flows from the recuperator to the gas inlet through the pipe.

16. A plasma generating system as recited in claim 15, wherein the recuperator has an enclosed space thereinside and one or more baffles disposed inside the enclosed space and wherein heat energy is transferred from the one or more baffles to the inlet gas.

17. A plasma generating system as recited in claim 15, wherein the recuperator has one or more baffles that are disposed in the gas passageway and wherein the one or more baffles recover heat energy from the exhaust gas.

18. A plasma generating system as recited in claim 15, wherein each of the one or more baffles is arranged in parallel to a flow direction of the exhaust gas exiting the gas outlet.

19. A plasma generating system as recited in claim 15, wherein each of the one or more baffles is rifled relative to a flow direction of the exhaust gas exiting the gas outlet.

20. A plasma generating system as recited in claim 15, wherein the gas inlet is configured to introduce the input gas into the plasma cavity as a vortex flow.

21. A plasma generating system as recited in claim 15, further comprising:

a plasma stabilizer having a shape of a circular hollow cylinder and protruding into the plasma cavity, wherein a portion of the gas inlet is disposed inside the plasma stabilizer.