CLAIMS

1. A method for selective catalytic reduction of NOx comprising:

providing an exhaust stream from a combustion operation, the exhaust stream containing an amount of NOx;

introducing at least a portion of the exhaust stream and a reductant stream including ~~a low molecular weight hydrocarbon~~ propylene to a first catalytic reactor comprising a first catalyst including alumina loaded with silver, the reductant stream and the at least a portion of the exhaust stream being introduced to the first catalytic reactor at suitable operating conditions to reduce the amount of NOx in the exhaust stream; and

directing the NOx-reduced exhaust stream from the first catalyst to a second catalyst including zirconia loaded with at least one metal.

2. The method of claim 1, wherein the first catalytic reactor includes a vessel, and the second catalyst is within the vessel of the first catalytic reactor.

3. The method of claim 2, wherein the operating temperature of the first catalytic reactor is between about 200 °C and about 450 °C.

4. The method of claim 2, wherein the operating temperature of the first catalytic reactor is about 400 °C.

~~3.~~5. The method ~~according to anyone of the preceding claims~~ of claim 1, wherein the second catalyst is in a second catalytic reactor located downstream of the first catalytic reactor.

~~4. The method according to anyone of the preceding claims, wherein the low molecular weight hydrocarbon is propylene.~~

~~5.~~6. The method of claim ~~4~~ 1, wherein the exhaust stream includes between about 0.5% and about 20 % oxygen and about 1-10 % water.

~~6.~~7. The method of claim 4 1, wherein ~~providing~~ the reductant stream ~~comprises providing~~ provides a molar ratio of propylene to NOx of about 0.5 to 2.

~~7. The method of claim 4, wherein the operating temperature of the first catalytic reactor is between about 200 °C and about 450 °C.~~

~~8. The method of claim 4, wherein the operating temperature of the first catalytic reactor is about 400 °C.~~

~~9.~~8. The method of claim 4 1, wherein ~~providing~~ the reductant propylene stream comprises ~~providing~~ up to about 500-5000 ppm of hydrogen.

~~10.~~9. The method of claim 4 1, wherein the first catalyst comprises 2 wt. % silver loaded on alumina.

~~11.~~10. The method of claim 4 1, wherein the loaded metal of the second catalyst is selected from the group consisting of copper, cerium, and tungsten.

~~12.~~11. The method of claim 4 1, wherein the second catalyst is selected from the group consisting of $Cu/W/ZrO_2$ and Ce/ZrO_2.

~~13.~~12. The method ~~according to anyone of the preceding claims~~ of claim 1, wherein the amount of NOx is reduced by at least 90%.

~~14.~~13. The method ~~according to anyone of the preceding claims~~ of claim 1, wherein the first catalytic reactor is located relative a refinery flue of the at least one refinery component to maintain the first catalytic reactor between 200 °C and 400 °C.

~~15.~~14. The method ~~according to anyone of the preceding claims~~ of claim 1, wherein the operating temperature of the first catalytic reactor is maintained between 200 °C and 400 °C by heating or cooling the exhaust stream.

~~16.~~15. The method ~~according to anyone of the preceding claims~~ of claim 1, wherein introducing the propylene reducant stream and the ~~at least a portion of the~~ exhaust stream collectively have a gaseous hourly space velocity of between 30K cc per hour and 120K cc per hour through the first catalytic reactor.

~~17.~~16. The method ~~according to anyone of the preceding claims~~ of claim 1, wherein the exhaust stream is provided from at least one refinery component selected from the group consisting of a combustion furnace, a boiler, a heater turbine, and a fluid catalytic cracking unit.

~~18. A system for selective catalytic reduction of NOx comprising:~~

~~a conduit in fluid communication with a source of an exhaust stream from a combustion operation, the exhaust stream containing an amount of NOx;~~

~~a source of a reductant stream including a low molecular weight hydrocarbon;~~

~~a first catalytic reactor in fluid communication with the conduit and the source of the reductant stream, the first catalytic reactor comprising a first catalyst including alumina loaded with silver;~~

~~an outlet in fluid communication with the first catalytic reactor to direct the NOx-reduced exhaust stream from the first catalytic reactor; and~~

~~a second catalyst including zirconia loaded with at least one metal, the second catalyst in fluid communication with the first catalyst.~~

~~19. The system of claim 18, wherein the first catalytic reactor includes a vessel, and the second catalyst is within the vessel of the first catalytic reactor.~~

~~20. The system according to anyone of claims 18 or 19, wherein the second catalyst is in a second catalytic reactor located downstream of the first catalytic reactor.~~

~~21. The system according to anyone of claims 18 to 20, wherein the low molecular weight hydrocarbon is propylene.~~

~~22. The system according to anyone of claims 18 to 21, wherein the first catalyst comprises 2 wt. % silver loaded on alumina.~~

~~23. The system according to anyone of claims 18 to 22, wherein the loaded metal of the second catalyst is selected from the group consisting of copper, cerium, and tungsten.~~

~~24. The system according to anyone of claims 18 to 23, wherein the second catalyst is selected from the group consisting of $Cu/W/ZrO_2$ and Ce/ZrO_2.~~

~~25. The system according to anyone of claims 18 to 24, wherein the source of the exhaust stream is a refinery component selected from the group consisting of a combustion furnace, a boiler, a heater turbine, and a fluid catalytic cracking unit.~~

~~26. The system of claim 26, wherein the first catalytic reactor is located downstream from a flue of the at least one refinery component to maintain the first catalytic reactor between about 200 °C and about 400 °C.~~

~~27. The system of claim 26, further comprising a heat exchanger operatively coupled to heat the exhaust stream to maintain the first catalytic reactor at a temperature of between about 200 °C and about 400 °C.~~