CLAIMS

1. A system for removing methane oxidation catalyst (MOC) poisons from an exhaust gas, comprising:

a methane abatement unit configured to receive the exhaust gas comprising methane (CH_4) and the MOC poisons, wherein the methane abatement unit comprises:

a guard bed configured to remove the MOC poisons from the exhaust gas and to generate an intermediate exhaust gas comprising the CH_4 and devoid of the MOC poisons, wherein the guard bed comprises a MOC poisons capturing component comprising a first transition metal oxide, an aluminum oxide (Al_2O_3) support material, and a dolomite-derived support material; and

a MOC bed fluidly coupled to and positioned downstream from the guard bed, wherein the MOC bed comprises a MOC and is configured to remove CH_4 from the intermediate exhaust gas to generate a treated exhaust gas having less than 200 parts per million volume (ppmv) CH_4.

2. The system of claim 1, wherein the MOC poisons capturing component is a physical mixture of a first component comprising the first transition metal oxide and the Al_2O_3 support material and a second component comprising a second transition metal oxide and the dolomite-derived support material, wherein the second transition metal oxide is the same or different from the first transition metal oxide.

3. The system of claim 2, wherein a ratio of the first component and the second component in the physical mixture is between 2:1 and 1:2

4. The system of claim 1, wherein the MOC poisons capturing component is a co-extrudate of the first transition metal oxide, the Al_2O_3 support material, and the dolomite-derived support material such that the MOC poisons capturing component is a single component.

5. The system of claim 1, wherein the guard bed is a single layer bed.

6. The system of claim 1, wherein the guard bed is a multi-layer bed having a first layer comprising the first transition metal oxide and the Al_2O_3 support material and a second layer comprising a second transition metal oxide and the dolomite-derived support material, wherein the second transition metal oxide is the same or different from the first transition metal oxide.

7. The system of claim 1, wherein the first transition metal oxide concentration in the MOC poisons capturing component is between 3-20% wt.

8. The system of claim 1, wherein the dolomite-derived support material is dolomite ($CaMg(CO_3)_2$), calcium magnesium oxide ($CaMgO_2$), a mixture of lime (CaO) and MgO, or a combination thereof.

9. The system of claim 1, wherein the first transition metal oxide is an oxide of manganese (Mn), vanadium (V), copper (Cu), and combinations thereof.

10. A method for removing methane oxidation catalyst (MOC) poisons from an exhaust gas, comprising:

feeding the exhaust gas comprising methane (CH_4) and the MOC poisons to a methane abatement unit comprising a guard bed and a MOC bed fluidly coupled to and downstream from the guard bed;

contacting the exhaust gas with a MOC poisons capturing component disposed within the guard bed, wherein the MOC poisons capturing component comprises a first transition metal oxide, an aluminum oxide (Al_2O_3) support material, and a dolomite-derived support material; and

removing the MOC poisons from the exhaust gas to generate an intermediate exhaust gas devoid of MOC poisons and comprising the CH_4.

11. The method of claim 10, wherein the step of contacting the exhaust gas with the MOC poisons capturing component comprises passing the exhaust gas through a single layer of the MOC poisons capturing component, wherein the MOC poisons capturing component is a co-extrudate of the first transition metal oxide, the Al_2O_3 support material, and the dolomite-derived support material.

12. The method of claim 10, wherein the step of contacting the exhaust gas with the MOC poisons capturing component comprises passing the exhaust gas through a single layer of the MOC poisons capturing component, wherein the MOC poisons capturing component is a physical mixture of a first component comprising the first transition metal oxide and the Al_2O_3 support material and a second component comprising a second transition metal oxide and the dolomite-derived support material, and wherein the second transition metal oxide is the same or different from the first transition metal oxide.

13. The method of claim 10, wherein the step of contacting the exhaust gas with the MOC poisons capturing component comprises passing the exhaust gas through a first MOC capturing component layer configured to remove a first portion of the MOC poisons and to generate an intermediate gas stream, and passing the intermediate gas steam through a second MOC poisons capturing component layer configured to remove a second portion of the MOC poisons and to generate the intermediate exhaust gas, wherein the first MOC capturing component layer comprises a first component having the first transition metal oxide and the Al_2O_3 support material and the second MOC poisons capturing layer comprises a second component having a second transition metal oxide and the dolomite-derived support material, and wherein the second transition metal oxide is the same or different from the first transition metal oxide.

14. The method of claim 10, comprising feeding the intermediate exhaust gas to the MOC bed having a MOC and removing the CH_4 from the intermediate gas to generate a treated exhaust gas having less than 200 parts per million volume (ppmv) CH_4.

15. A methane oxidation catalyst (MOC) poisons capturing component for removing MOC poisons from an exhaust gas, comprising:

an aluminum oxide (Al_2O_3) support material having a first porosity;

a dolomite-derived support material having a second porosity that is less than the first porosity;

a first transition metal oxide supported on the Al_2O_3 support material, the dolomite-derived support material, or both, wherein a concentration of the first transition metal oxide is between 1-25 weight % (wt %); and

wherein the MOC poisons capturing component removes sulfur dioxide (SO_2), phosphorus (P), calcium (Ca), zinc (Zn), silicon (Si) and ash.

16. The MOC poisons capturing component of claim 15, wherein the MOC poisons capturing component is a physical mixture of a first component comprising the first transition metal oxide and the Al_2O_3 support material and a second component comprising a second transition metal oxide and the dolomite-derived support material, wherein the second transition metal oxide is the same or different from the first transition metal.

17. The MOC poisons capturing component of claim 16, wherein a ratio of the first component and the second component in the physical mixture is between 2:1 and 1:2

18. The MOC poisons capturing component of claim 15, wherein the MOC poisons capturing component is a co-extrudate of the first transition metal oxide, the Al_2O_3 support material, and the dolomite-derived support material such that the MOC poisons capturing component is a single component

19. The MOC poisons capturing component of claim 15, wherein the dolomite-derived support material is dolomite ($CaMg(CO_3)_2$), calcium magnesium oxide ($CaMgO_2$), a mixture of lime (CaO) and MgO, or a combination thereof.

20. The MOC poisons capturing component of claim 15, wherein the transition metal oxide is an oxide of manganese (Mn), vanadium (V), copper (Cu), and combinations thereof.

21. The MOC poisons capturing component of claim 15, wherein the first porosity is greater than 2.0 milliliters (mL)/gram (g).

22. The MOC poisons capturing component of claim 15, wherein the second porosity is less than 0.2 mL/g.