

CLAIMS

What is claimed is –

1. A method of producing synthesis gas comprising:
5 feeding a waste plastic feedstock into a partial oxidation gasifier, said waste plastic feedstock comprising waste plastic and one or more vitrification materials directly derived from said waste plastic; and partially oxidizing said waste plastic within said partial oxidation gasifier to produce said synthesis gas.
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2. A method of producing synthesis gas comprising:
feeding a waste plastic feedstock into an entrained flow partial oxidation gasifier, said feedstock comprising at least 1% by weight of one or more vitrification materials based on the weight of said feedstock;
15 and partially oxidizing said waste plastic within said entrained flow partial oxidation gasifier to produce said synthesis gas.
3. A method of producing synthesis gas comprising:
20 feeding one or more vitrification materials separated from a mixed plastic waste into a partial oxidation gasifier; and producing said synthesis gas within said partial oxidation gasifier.
4. A method of producing synthesis gas comprising:
25 feeding a feedstock comprising one or more fossil fuels, one or more plastic materials, and one or more vitrification materials other than vitrification materials contained in said fossil fuel to a partial oxidation gasifier; and producing said synthesis gas within said partial oxidation gasifier.
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5. The method of any of claims 1-4, wherein said partial oxidation gasifier is operated in conditions that produce slag.
- 5 6. The method of claim 5, wherein the slag includes at least a portion of said one or more vitrification materials directly derived from plastic material of said feedstock.
- 10 7. The method of any of claims 1-4, further comprising sorting a mixed plastic waste into a heavies-enriched stream and heavies-depleted stream, wherein at least a portion of said one or more vitrification materials are included in said heavies-depleted stream.
- 15 8. The method of claim 7, further comprising performing a density separation process on the heavies-depleted stream to form a stream enriched in vitrification materials, and wherein at least a portion of the one or more vitrification materials fed to said partial oxidation gasifier are contained in the stream enriched in vitrification materials.
- 20 9. The method of any of claims 1-4, wherein said feedstock comprises a polyethylene terephthalate (PET)-depleted stream separated from mixed plastic waste by a density separation process, at least a portion of the one or more vitrification materials fed to said partial oxidation gasifier being directly derived from the waste plastic of said PET-depleted stream.
- 25 10. The method of any of claims 1-4, wherein said feedstock is at least in part obtained by separation of mixed plastic waste including a density separation process that produces at least a high density
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stream having a density at 25°C of at least 1.35 g/cc and/or not more than 1.45 g/cc and a low density stream having a density at 25°C of less than the density of the high density stream and/or at least 1.25 g/cc.

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11. The method of claim 10, wherein at least a portion of said one or more vitrification materials is not obtained from said mixed plastic waste and said portion of said one or more vitrification materials comprises one or more of glass, sand, calcium carbonate,
10 aluminum, coal slag, igneous rocks, granite, basalt, gabbro, andesite, diorite, rhyolite, feldspar, olivine, quartz, obsidian, pyroxene, plagioclase, amphibole, and mica.
12. The method of any of claims 1-4, wherein said one or more
15 vitrification materials are at least in part obtained from at least one of a decanter, a solid-liquid separation (filter), a reactor purge, and a distillation column bottoms stream of said solvolysis facility.
13. The method of any of claims 1-4, wherein said feedstock to the
20 partial oxidation gasifier includes regulated leachable materials in the amount of at least 0.1 weight percent of the feed and/or not more than 25 weight percent of the feed.
14. The method of any of claims 1, 2, or 4, wherein at least a portion of
25 said one or more vitrification materials are derived from a mixed plastic waste stream.
15. The method of claim 14, further comprising sorting the mixed plastic
30 waste into a heavies-depleted stream and a heavies-enriched stream, the heavies-enriched stream comprising one or more of ferrous metals, non-ferrous metals, glass, and dirt.

- 5 16. The method of claim 15, wherein the portion of said one or more vitrification materials comprises fillers, additives and modifiers of waste plastic of the mixed plastic waste stream.
- 10 17. The method of any of claims 1-4, wherein at least a portion of said one or more vitrification materials comprises soot and/or slag obtained from a gasification process.
18. The method of claim 4, wherein said fossil fuel of said feedstock comprises coal.
- 15 19. The method of any one of claims 1-18, comprising:
separating a mixed plastic waste into a polyethylene terephthalate (PET)-enriched plastic stream and a polyolefin-enriched PET-depleted plastic stream;
feeding at least a portion of said polyolefin-enriched PET-depleted plastic stream and one or more vitrification materials to a partial oxidation gasifier; and
20 partially oxidizing at least a portion of one or more polyolefins contained within said polyolefin-enriched PET-depleted plastic stream within said partial oxidation gasifier to produce said synthesis gas.
- 25 20. The method of any one of claims 1-4, further comprising:
separating a waste plastic to produce a vitrification materials stream comprising one or more vitrification materials and between four and fifty percent (4-50%) by weight of one or more plastic materials; and
30 feeding a feedstock to a partial oxidation gasifier along with at least a portion of said vitrification materials stream; and

partially oxidizing at least a portion of said feedstock within said partial oxidation gasifier to produce said synthesis gas.

- 5 21. The method of any one of claims 1-4 or claim 20, wherein said vitrification materials are added to a melt tank of a gasification facility that includes the partial oxidation gasifier.
- 10 22. A method of any one of claims 1-4, further comprising:
 feeding a feedstock to a partial oxidation gasifier of a partial oxidation gasification facility, said feedstock comprising a waste plastic and a vitrification material stream enriched in one or more vitrification materials obtained from a chemical recycling facility other than said partial oxidation gasification facility;
15 partially oxidizing at least a portion of said waste plastic within said partial oxidation gasifier to produce said synthesis gas; and
 forming within said partial oxidation gasifier a slag comprising at least a portion of said one or more vitrification materials.
- 20 23. The method of claim 22, wherein said solvolysis chemical recycling facility comprises a methanolysis, glycolysis, or hydrolysis facility.
- 25 24. The method of claim 23, wherein said vitrification material stream is at least in part obtained from a pyrolysis reactor of a pyrolysis facility.
- 30 25. A partial oxidation gasifier feed composition comprising a waste plastic obtained from a mixed plastic waste and one or more solid vitrification materials, at least a portion of said one or more solid vitrification materials being directly derived from said mixed plastic waste.