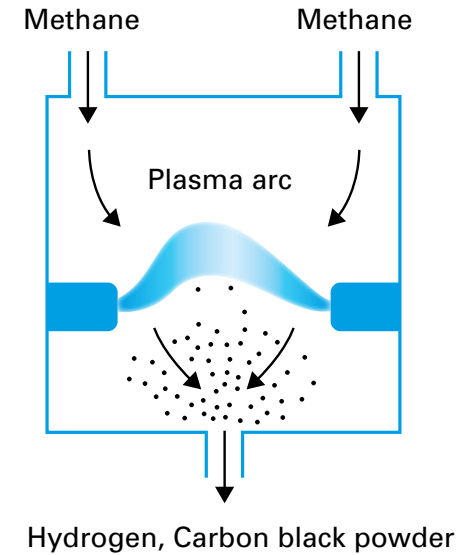
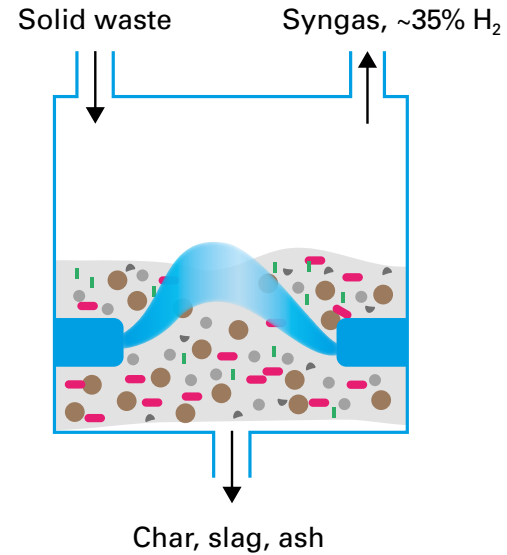
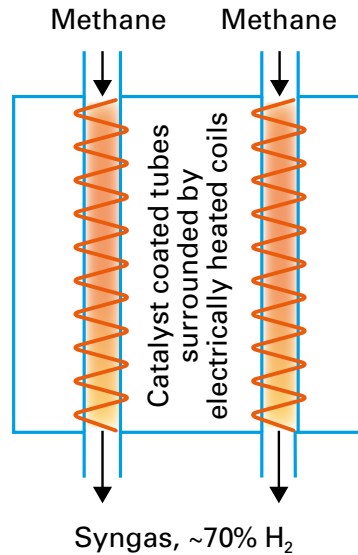


Notes:

- Combustion-heated SMR is an alternative to electrical heating
- Thermal or catalytic methane pyrolysis are alternatives to plasma
- Steam may be added to the waste gasifier to increase hydrogen yield, if waste is very dry
- For the plasma gasification reaction stoichiometry shown, methane is used as an example hydrocarbon
- Electrolysis is an alternative electrically powered pathway to produce hydrogen from water (AEC, PEM, SOE) or syngas from steam and carbon dioxide (SOE)



| Process | Electrical Steam Methane Reforming (eSMR) | Plasma Gasification of Solid Hydrocarbons, eg waste | Plasma Pyrolysis of Methane (Methane Cracking, Methane Splitting) |
|---------------------------|--|---|---|
| Carbon feedstock | Natural gas, refinery gas or naphtha | Municipal solid waste, dried waste water treatment sludge, biomass, waste paper, tyres, etc | Methane from natural gas |
| Target chemical reactions | $\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$ | $\text{Hydrocarbon} + \text{O}_2 \rightarrow 2\text{CO} + 4\text{H}_2$ $\text{Hydrocarbon} + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$ | $\text{CH}_4 \rightarrow \text{C} + 2\text{H}_2$ |
| Additional side reactions | $\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2$ | $\text{Hydrocarbon} + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ | $2\text{CH}_4 \rightarrow \text{C}_2\text{H}_2 + 3\text{H}_2$ |
| Carbon produced as | CO and CO ₂ | CO, CO ₂ , char, slag and ash | Carbon black powder |
| Product gas pressure | 15 to 40 bar | Close to atmospheric pressure | Close to atmospheric pressure |
| Product gas temperature | ~850 °C | ~1000 °C | 1500 to 2000 °C |