# Methane pyrolysis technologies for turquoise hydrogen production

## Methods

### AC Graphite Electrode Plasma Arc
- **Process shown**: Plenesys
- **Hydrogen content at reactor outlet**: ~98% using recycle loop (70 to 80% single pass conversion)
- **Carbon production**: Solid carbon
- **Catalyst required**: No
- **Heating mechanism**: Hydrogen gas AC electrical plasma
- **Reactor temperature**: 1,500 to 1,800 °C
- **Reactor pressure**: Close to atmospheric pressure
- **Hydrogen, unreacted methane and solid carbon**
- **Quench water spray**

### Metal Electrode Plasma Arc
- **Process shown**: Based on the Hüls process
- **Hydrogen content at reactor outlet**: Potentially >95% hydrogen on single pass
- **Carbon production**: Solid carbon
- **Catalyst required**: No
- **Heating mechanism**: High temperature plasma arc (20,000 °C)
- **Reactor temperature**: Gases in the range of 1,200 to 1,500 °C
- **Reactor pressure**: Close to atmospheric pressure
- **Hydrogen, unreacted methane and solid carbon**
- **Vortex chamber**

### Microwave Plasma
- **Process shown**: Transform Materials
- **Hydrogen content at reactor outlet**: 86% hydrogen, 12% acetylene
- **Carbon production**: Solid carbon
- **Catalyst required**: No
- **Heating mechanism**: Microwave plasma
- **Reactor temperature**: 1,200 to 1,500 °C
- **Reactor pressure**: Close to atmospheric pressure
- **Hydrogen, unreacted methane, CO₂ and solid carbon**
- **Combustion flue gases**

### Pulsed Methane Pyrolysis (PMP)
- **Process shown**: Ekona Power
- **Hydrogen content at reactor outlet**: 70 to 80%
- **Carbon production**: Solid carbon & CO₂
- **Catalyst required**: No
- **Heating mechanism**: Partial combustion and fired heater
- **Reactor temperature**: 1,200 to 1,500 °C
- **Reactor pressure**: Pressure cycles up to 20 bar with each pulse at approximately 1 Hz

## Table Summary

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