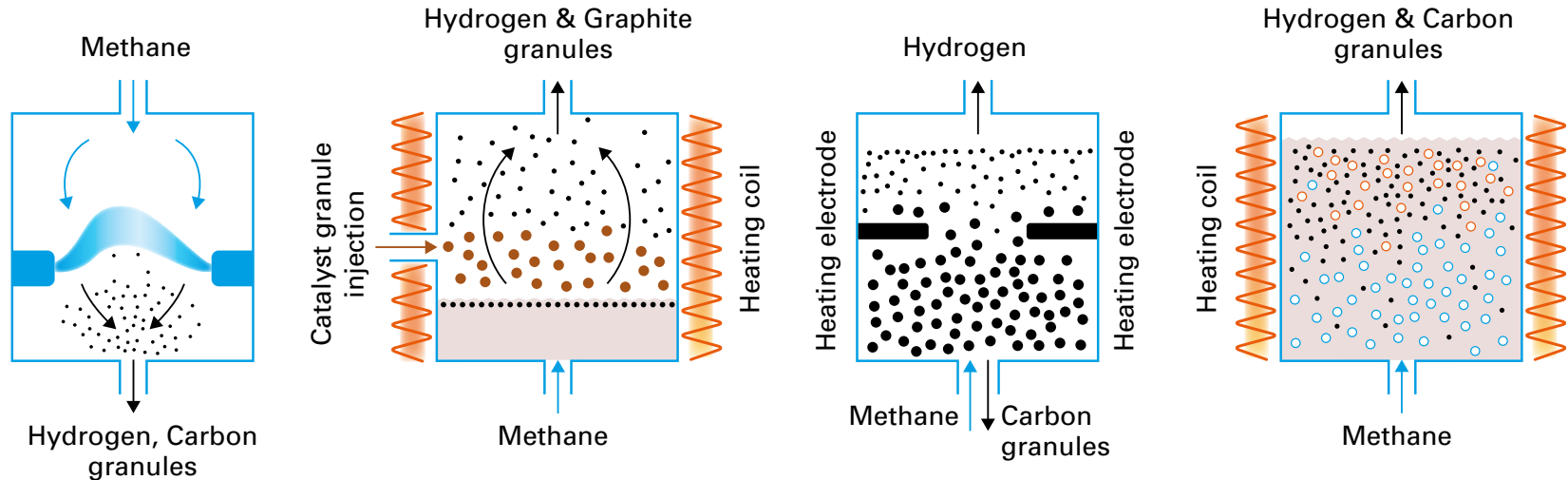


# Methane pyrolysis (cracking/splitting) for turquoise hydrogen production



## Notes:

- Unreacted methane can be separated from the hydrogen using PSA and recycled to the reactor
- The size of the carbon granules is influenced by operating conditions and the residence time of the carbon in the reactor
- Heat may be from renewable electricity
- Methane can be from natural gas or biogas



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	Plasma Pyrolysis	Fluidised Bed	Moving Carbon Bed	Molten Metal or Molten Salt
Process shown	Monolith Materials	Hazer	BASF	TNO or C-Zero
Hydrogen content at reactor outlet	~95%	~92%	~92%	Up to 95%
Carbon production	Carbon black as powder or granules	80 to 95% graphite encapsulating iron particles	Carbon black as powder or granules	Carbon black as powder or granules
Catalyst required	No	Iron oxide granules	Carbon bed	Molten 27% Nickel-73% Bismuth Molten Manganese Chloride
Heating mechanism	Direct heating with plasma	Indirect heat applied around the reactor	Electrodes to heat the carbon bed and indirect heat applied around the reactor	Indirect heat applied around the reactor or electrodes to heat the melt in a separate vessel
Reactor temperature	2000 °C	900 °C	1000 to 1400 °C	Depends on melt, 650 to 1100 °C
Reactor pressure	Close to atmospheric pressure	Close to atmospheric pressure	Close to atmospheric pressure	Up to 5 bar