



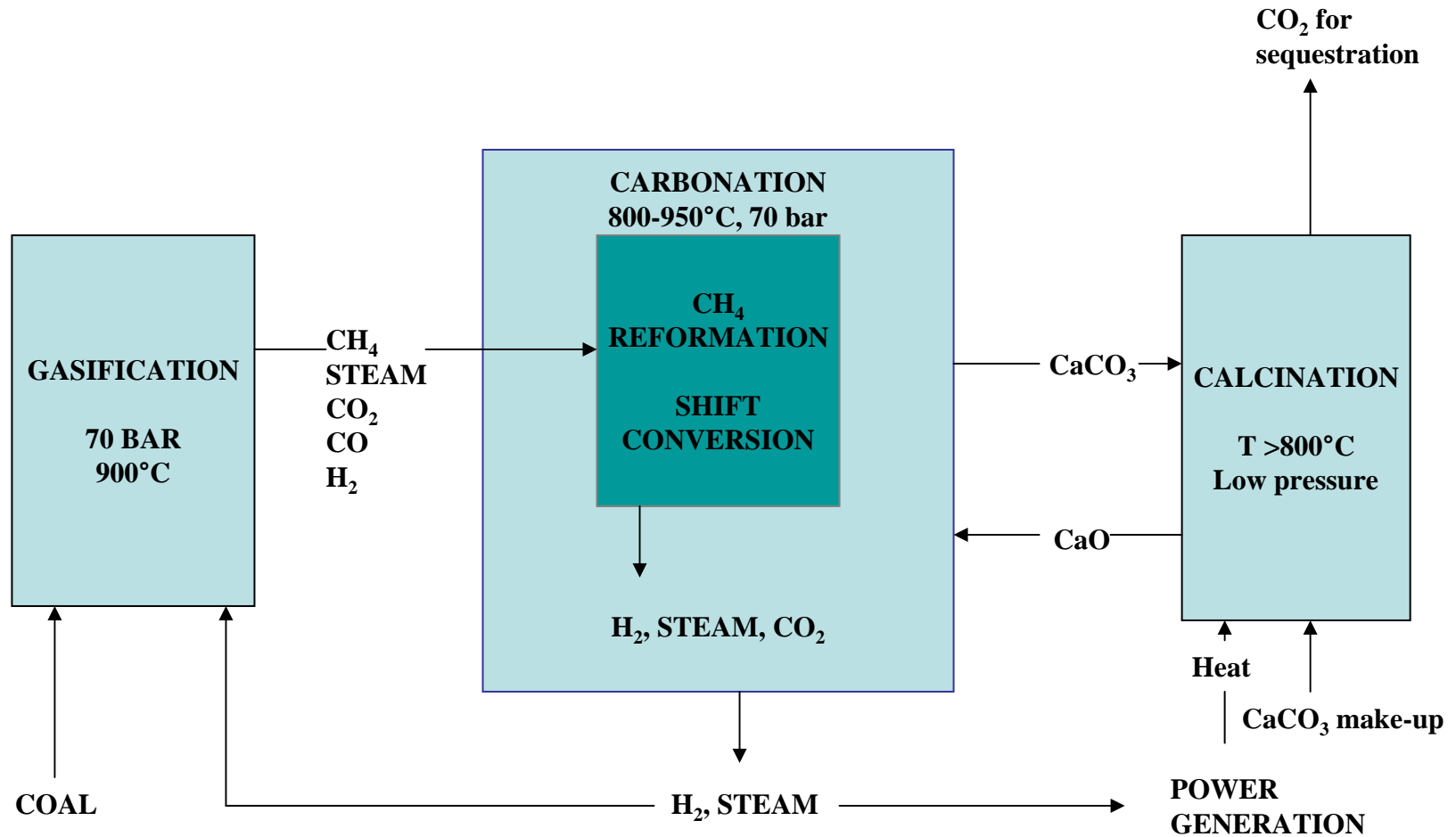
IMPERIAL COLLEGE LONDON
DEPARTMENT OF CHEMICAL ENGINEERING AND CHEMICAL TECHNOLOGY

UNIVERSITY OF CAMBRIDGE
DEPARTMENT OF CHEMICAL ENGINEERING

**A STUDY OF THE REACTION CHEMISTRY IN THE PRODUCTION OF
HYDROGEN FROM COAL USING A NOVEL PROCESS CONCEPT**

Lu Gao, Imperial College London
N Paterson
R Kandiyoti
D R Dugwell

R Pacianni, University of Cambridge
P Fennell
J S Dennis
AN Hayhurst
J F Davidson F.R.S

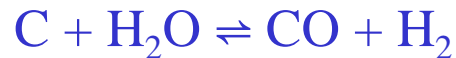


FLOW DIAGRAM OF THE ZECA CONCEPT



HYDROGASIFICATION

Reactions in the gasifier:

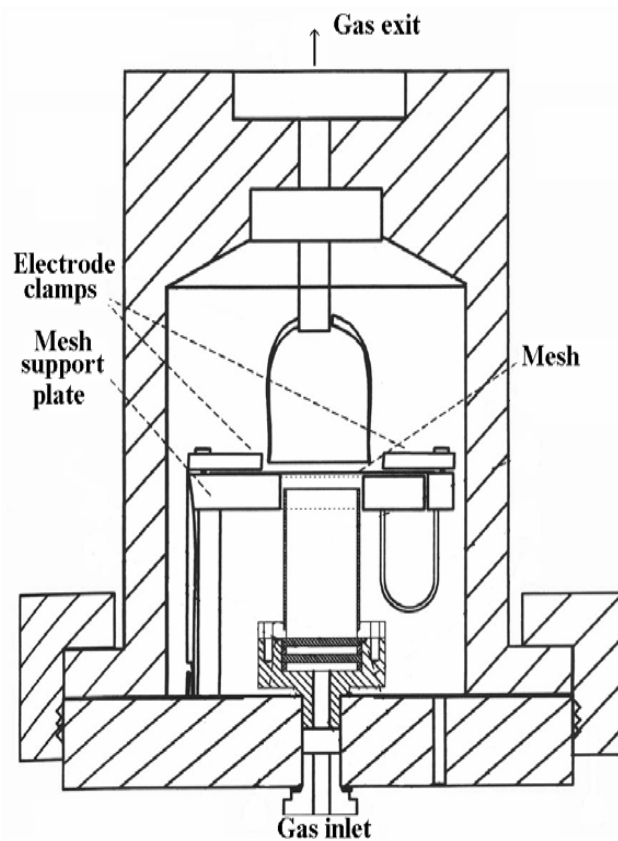


Questions to be addressed:

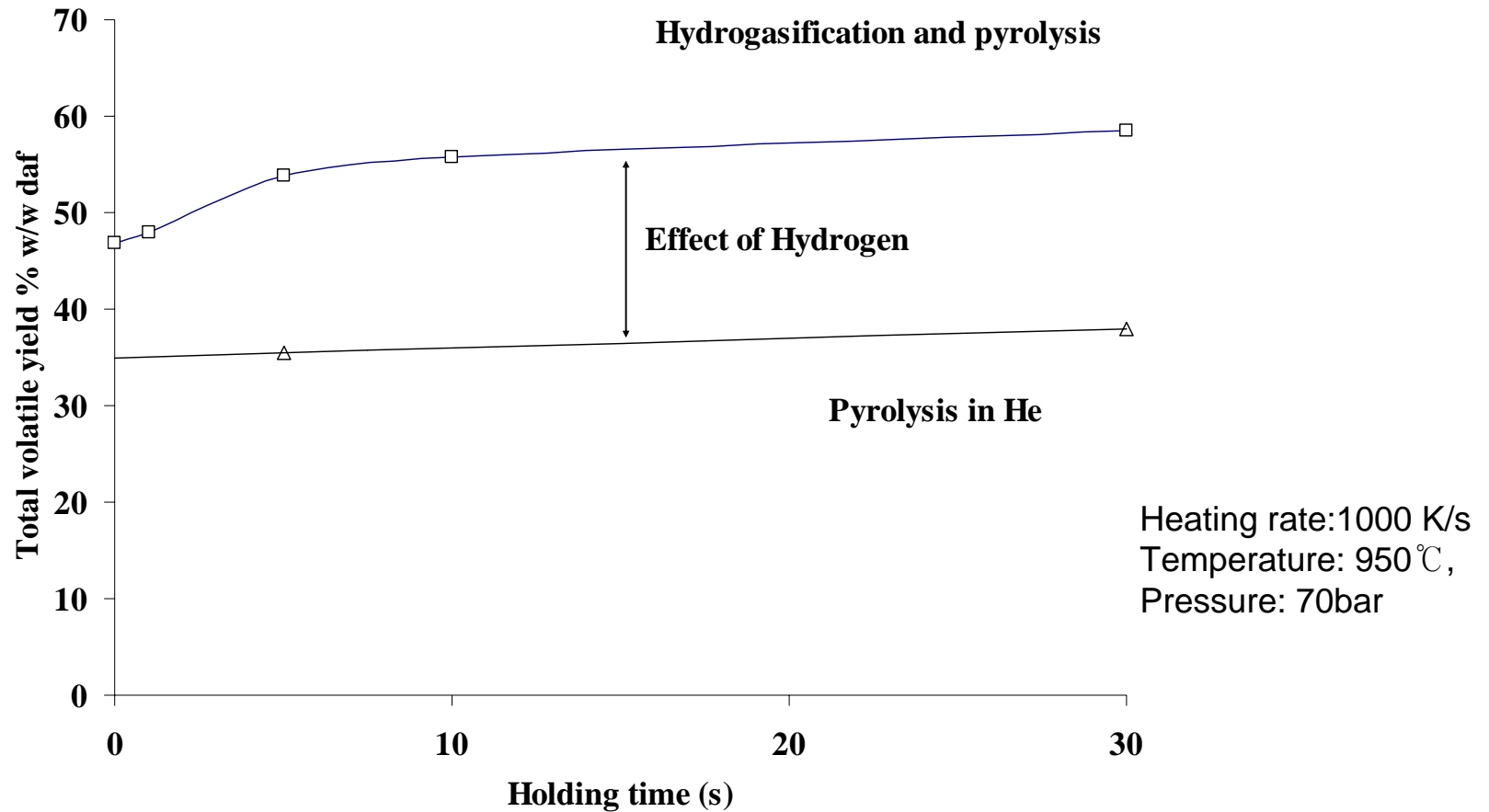
- What conditions are needed to attain the maximum concentration of CH_4
- What is the importance of the C-steam reaction under these conditions
- What level of fuel conversion can be achieved
- What is the nature of residual chars

Outcome:

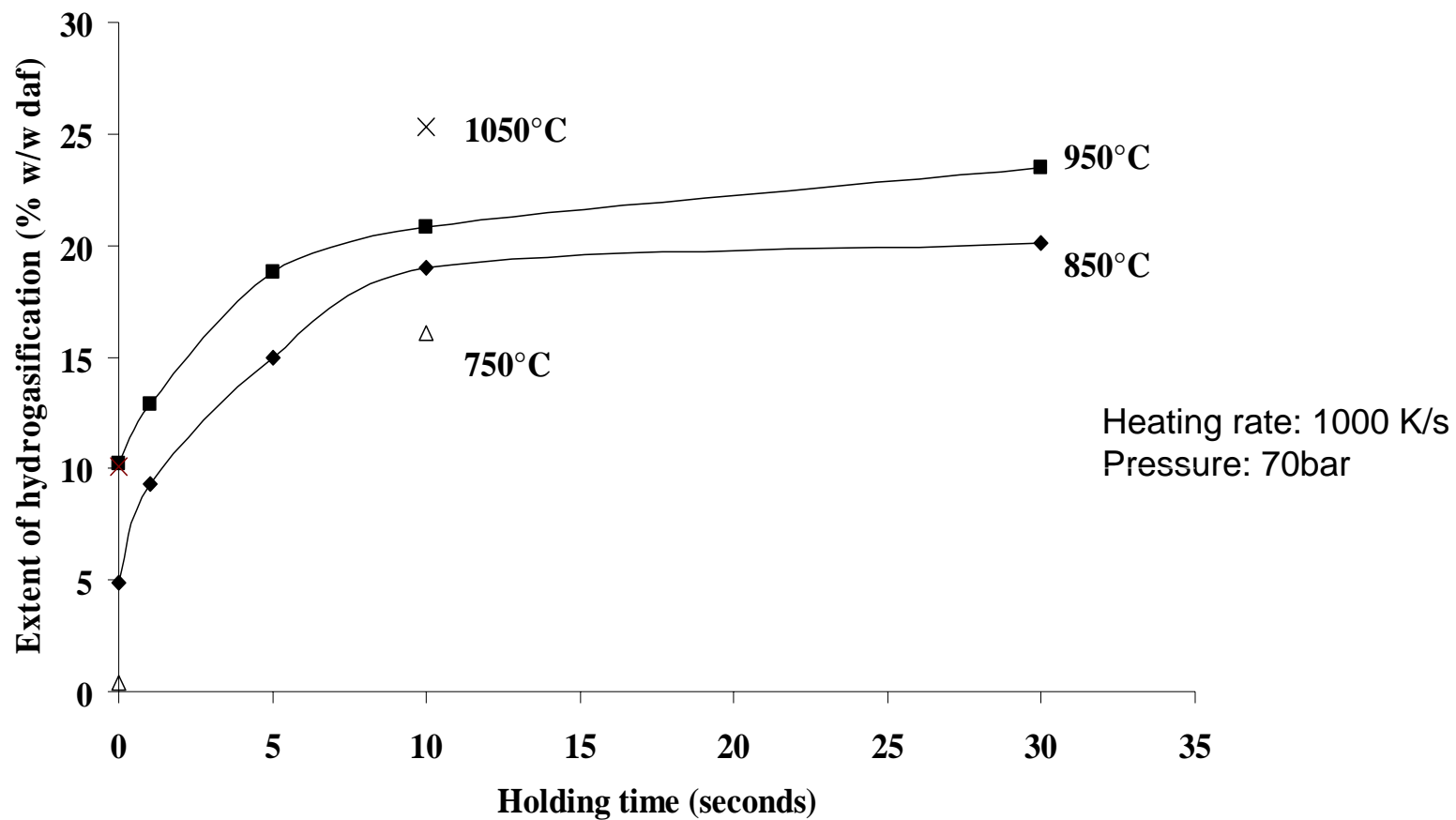
Data on the reaction chemistry in the gasification stage and an indication of the levels of conversion and operating conditions



THE HIGH PRESSURE WIRE MESH REACTOR



Effect of Hold Time on Total Volatile Yield from the hydrogasification and pyrolysis of Daw Mill coal



Effect of hydrogen on total volatile yield of Daw Mill coal

Sample	Temp, °C	Flow gas	Hold Time, s	Total Volatile Yield, average, %, daf (extent hydrogasification)	Range of individual values, %, daf	No. of determinations
Mongolian lignite	950	H ₂	10	75 (39)	70-87	20
			0	38 (2)	33-39	4
	700*	He	10	36	35.5-35.9	4
			30	39	38.6-39.2	2
			10	35	34.8-35.5	4
Beulah Zap lignite	950	H ₂		81 (38)	62-90	10
			0	55 (12)	54.2-55.2	3
	700	He	10	43	42.6-44.0	3
				39	38.6-38.9	3

Pressure: 7 MPa, except * 0.12 MPa
Heating rate: 1000 Cs-1

Data obtained using Lignites

Hydrogen (%) in reactant gas	Fuel Sample	
	Daw Mill Coal	Beulah Zap Lignite
100	20	38
50	16	28

Effect of the Hydrogen Concentration

Temperature: 950°C

Hold Time 10s

Heating rate 1000°C/s

Pressure MPa (100% hydrogen)	Daw Mill Coal % Hydrogasification (daf basis)
7	20
5	18
3	11

Effect of Total Pressure

Work in progress

Gasification in steam: effect of operating conditions

Gasification in steam/hydrogen mixtures

Effect of hydrogen on the release of fuel-N

Project finishes 12 months.