

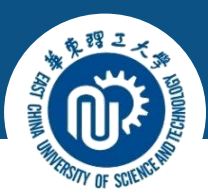
OMB Coal-Water Slurry Gasification Technology and Its Applications

Qinghua Guo

East China University of Science and Technology

June 24, 2020



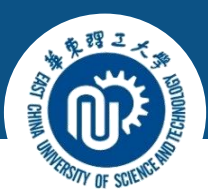


1 Introduction of ICCT at ECUST

2 OMB CWS gasification technology

3 Application of OMB CWS gasifiers

4 FactSage used for the gasifier operating

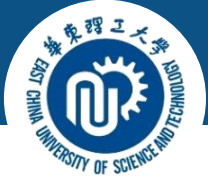


Introduction of ICCT at ECUST



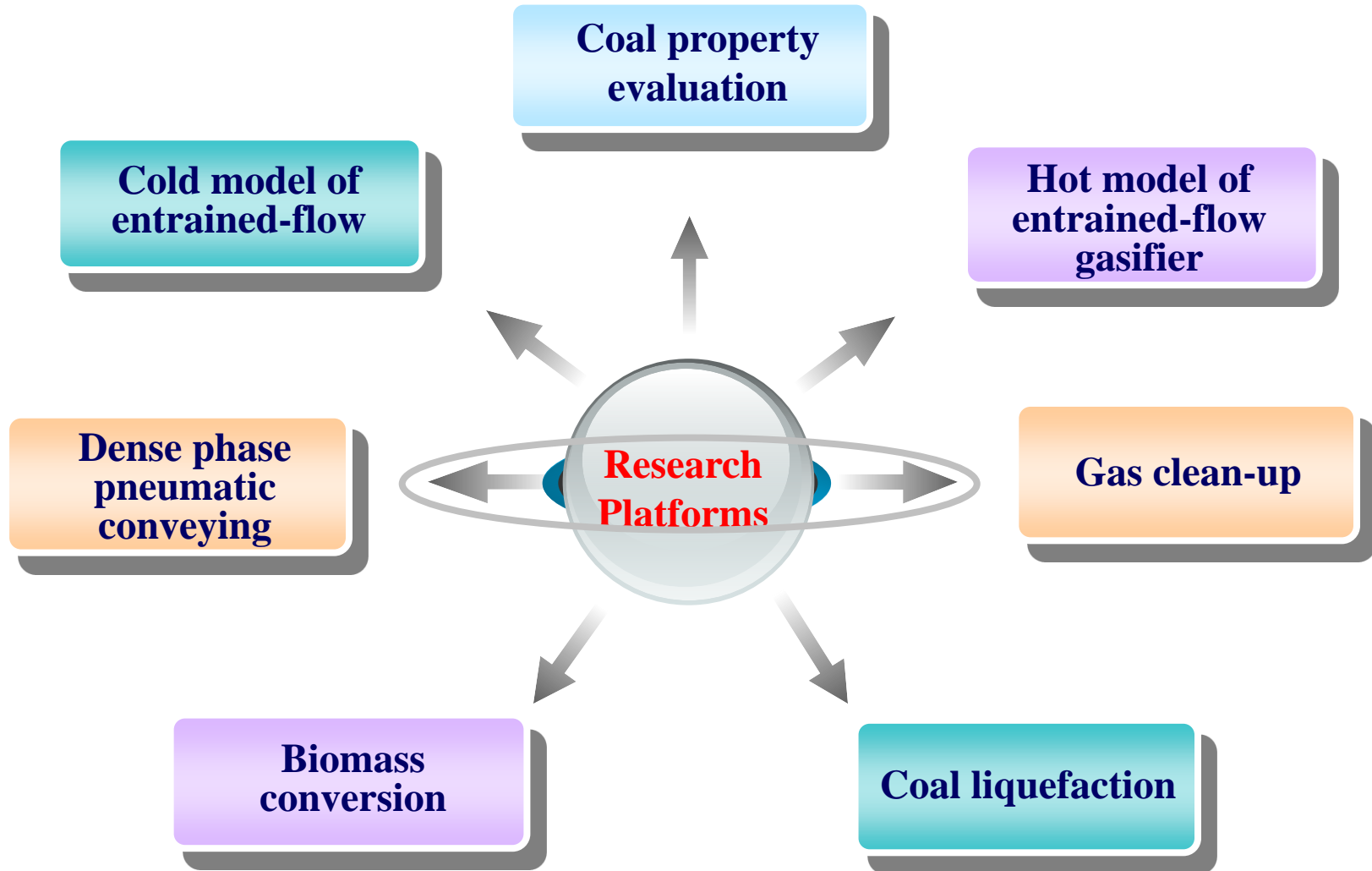
- Institute of Clean Coal Technology (ICCT) since 1995
- ~100 persons (19 faculties including 7 Prof., 9 Associate Prof. , and about 80 graduate students.)
- Coal Gasification Technology Research Center of National Energy Administration (NEA)
- Co-R&D center of ECUST and SINOPEC
- Gasification Engineering Center of Shanghai

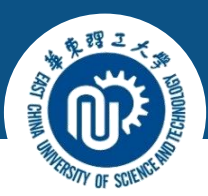




Introduction of ICCT at ECUST

Research fields





Introduction of ICCT at ECUST

Industrial technologies

Type of feed	Technology		Application state
Coal Petro-coke NG COG Shale Gas Residual oil Pitch	Opposed Multi-burner (OMB)	CWS	Commercial
		Dry Feed	Designing
	SE	CWS	Demonstration
		Dry Feed	Commercial
	POX	NG, COG	Commercial
		Pitch	Designing



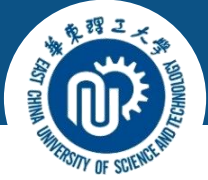
OMB



SE

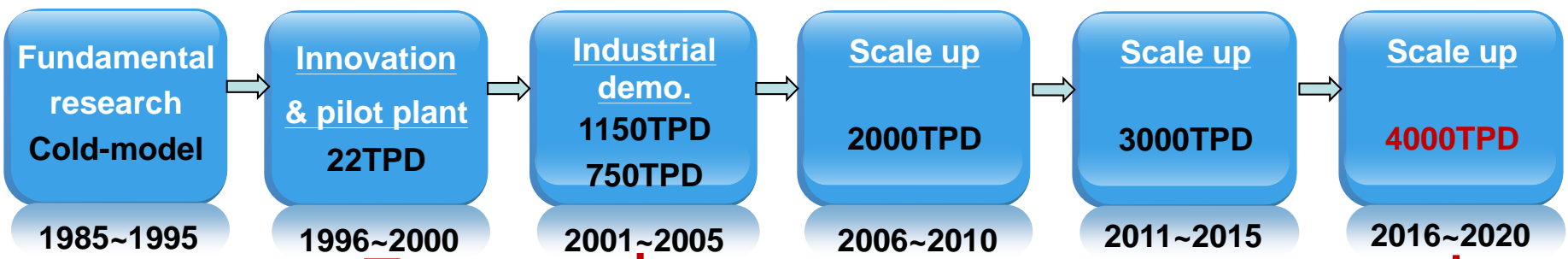


POX



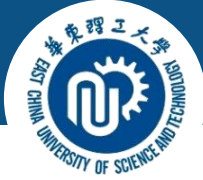
OMB CWS Gasification Technology

Development of OMB Coal Gasification Technology

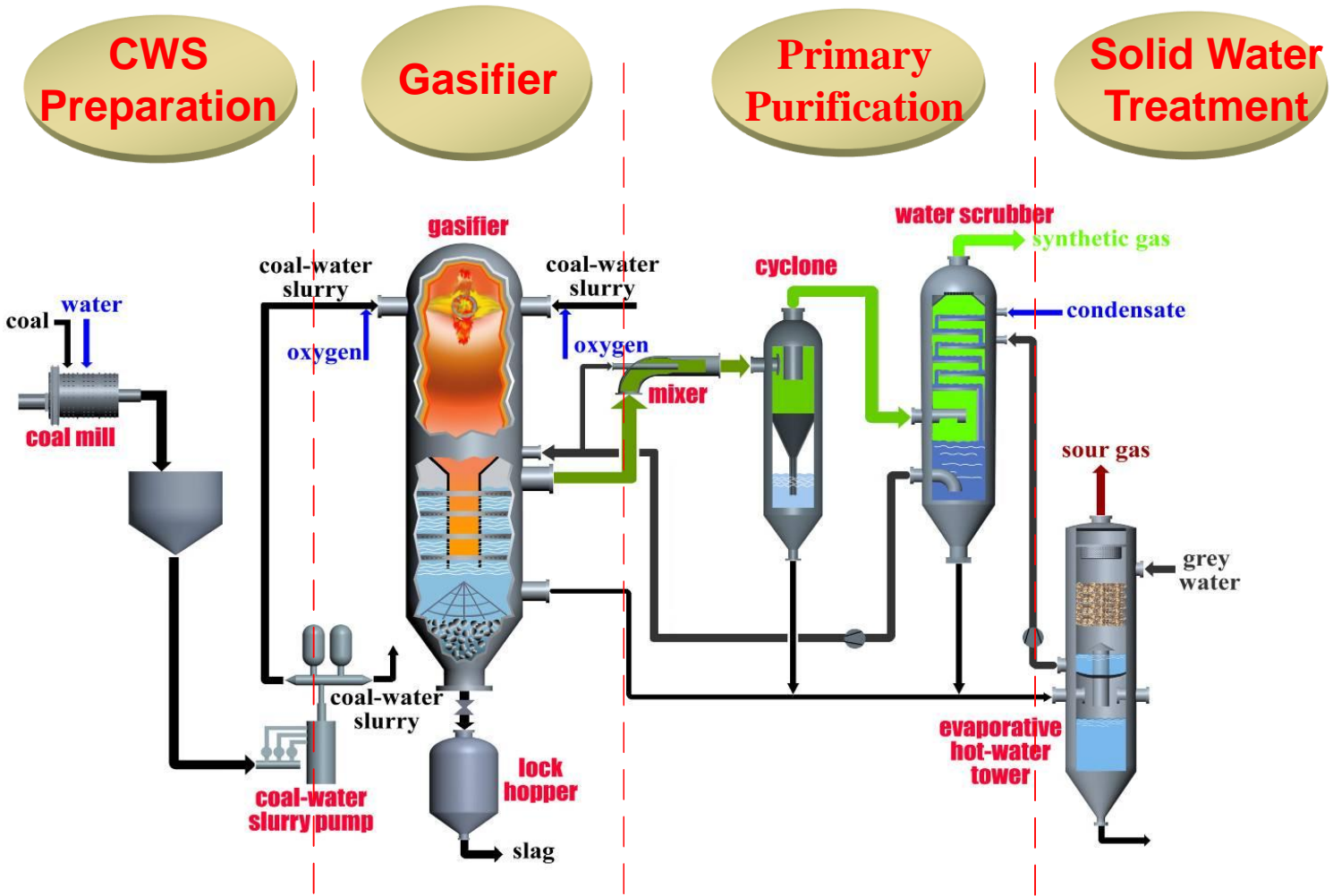


Supported by
State Development
Planning
Commission

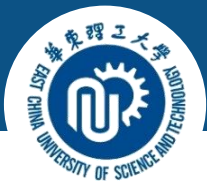
Supported by MOST
Hi-tech research and development program (863)



OMB CWS Gasification Technology



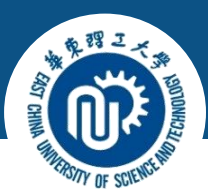
OMB CWS gasification technology process diagram



OMB CWS Gasification Technology

High Carbon Conversion

Project name	Capacity TPD O.P.+S.P.	Carbon conversion	Remarks
Yankuang Cathay Coal Chemicals Co.,Ltd.	1150 3+1	98.80%	Dec.11-18, 2005 168 hours continuous performance test
Xinneng Fenghuang (Tengzhou) Energy	1500 2+1	99.16%	Oct. 13-16, 2010 72 hours continuous performance test
Shenhua Ningxia Coal Group	2000 2+1	98.90%	Sep. 24-27, 2010 72 hours continuous performance test
Jiangsu Linggu Chemicals Co., Ltd.	2000 2+1	99.20%	Nov. 25-28, 2011 72 hours continuous performance test
Anhui Huayi Chemicals Co., Ltd.	1500 2+1	98.94%	Aug. 20-24, 2012 72 hours continuous performance test
Shanghai Coking & Chemical Corporation	2200 1+1	98.80%	Reported data
Yingde Gases in Anyang	2200 1+1	99.30%	Oct. 29-31, 2014 72 hours continuous performance test
Henan Xinlianxin Fertiliser Co., Ltd.	1200 2+1	98.70%	Jan. 12-14,2015 72 hours continuous performance test
Yantai Wanhua Co., Ltd.	1500 2+1	99.38%	Aug. 17-19, 2015 72 hours continuous performance test
Inner Mongolia Rongxin Chemical Co., Ltd.	3000 2+1	99.63%	Sep. 23-26, 2015 72 hours continuous performance test
Xinjiang Xinlianxin Fertiliser Co., Ltd.	1500 1+1	99.14%	Aug. 25-28, 2016 72 hours continuous performance test
.....			

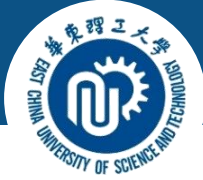


Application of OMB CWS Gasifiers

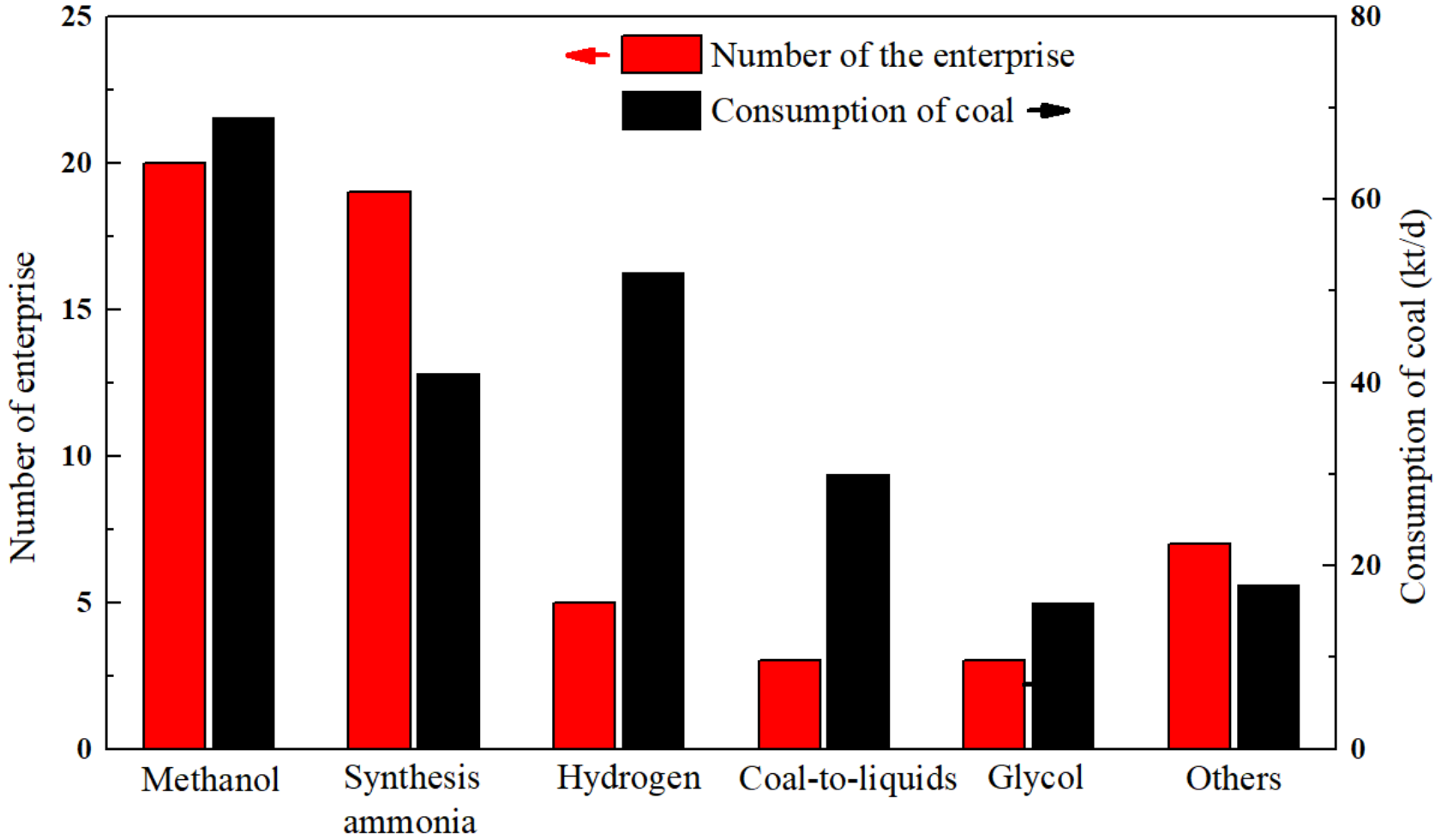
OMB Coal-water Slurry Gasification Technology



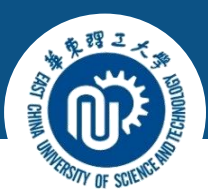
- 58 projects (159 gasifiers) in total
- 31 projects (85 gasifiers) in operating
- **The total capacity of coal for all projects is >220,000 TPD**
- **The capacity of single gasifier ranges from 750 to 4000 TPD**



Application of OMB CWS Gasifiers



Coal consumption of OMB for various kinds of products



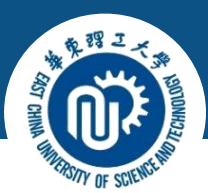
Application of OMB CWS Gasifiers

Projects started up in recent years

(1) Hengli Petrochemical (Dalian) Refinery Co., Ltd.

- Gasifiers: 5+1 (**3000 TPD**)
- Pressure: 6.5MPa(G)
- Products: Hydrogen & gas
- Syngas (CO+H₂) flowrate:
1,000,000Nm³/h
- Startup: Feb. 15, 2019



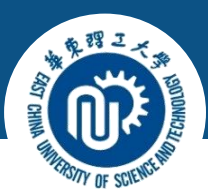


Application of OMB CWS Gasifiers

(2) Zhejiang Petrochemical Refinery Co., Ltd. Phase I and II

- Gasifiers: 8+4 (**3000 TPD**)
- Pressure: 6.5 MPa(G)
- Products: Hydrogen & gas
- Syngas (CO+H₂) flowrate:
 - 1.4 million Nm³/h
- Start construction: June, 2017
- Startup: **Nov. 14, 2019**





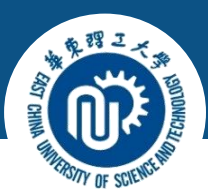
Application of OMB CWS Gasifiers

(3) Inner Mongolia Rongxin Chemical Co., Ltd

Largest single capacity gasifier in the world---4000 TPD

- Gasifiers: 2+1 (**4000 TPD**)
- Pressure: 6.5MPa(G)
- Products: Methanol & DMMn
- Syngas (CO+H₂) flowrate:
420,000Nm³/h
- Phase II
- Startup: **Oct. 29, 2019**



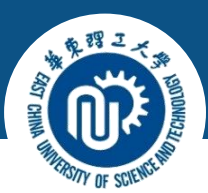


Application of OMB CWS Gasifiers

(4) Yankuang Yulin Energy Chemical Co., Ltd

- Gasifiers: 2+1(2000 TPD), 2 Quenching / **1 RSC**
- Pressure: 6.5MPa(G)
- Products: DMMn
- Startup time: Oct. 31, 2019 / **Oct. 2020 (as estimated)**



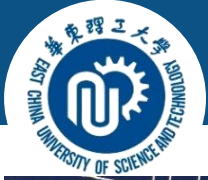


Application of OMB CWS Gasifiers

Radiant Syngas Cooler (RSC) combined with quenching chamber

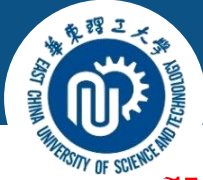
- ✓ Higher gasification efficiency than quenching process.
- ✓ By optimizing the combination of RSC and Quench chamber to adjust the syngas temperature and the steam/syngas ratio.
- ✓ Producing high pressure steam can meet the requirement of downstream, lower the coal consumption and pollutant emission.





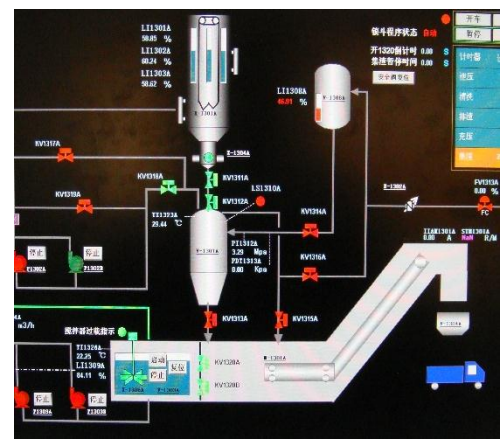
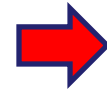
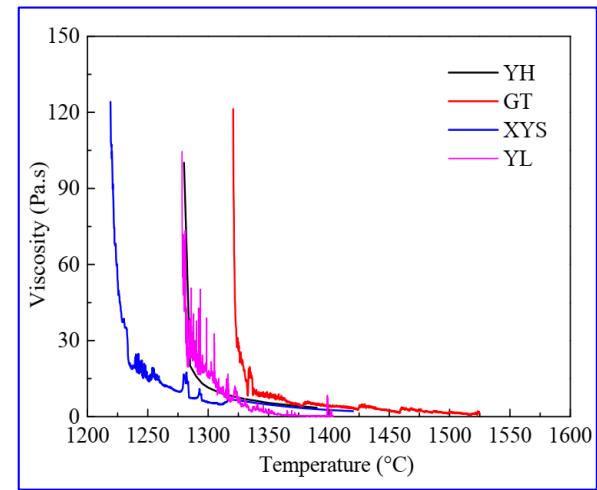
Application of OMB CWS Gasifiers





FactSage used for the gasifier operating

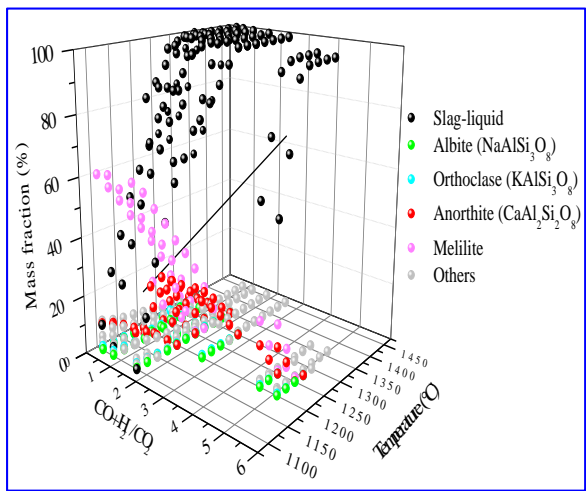
Slag phase change-Viscosity change-Industrial application



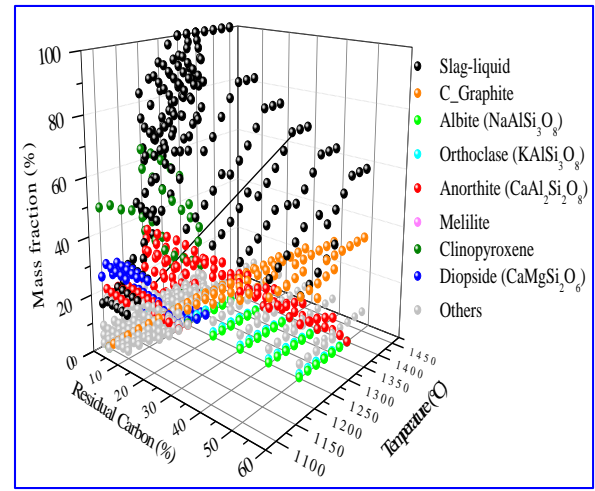
Fundamental research

Viscosity-temperature control

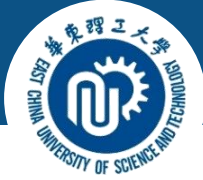
Gasifier discharging



Atmosphere-Slag-Temperature



Residual carbon-Slag-Temperature



FactSage used for the gasifier operating

Application of FactSage thermodynamic calculation

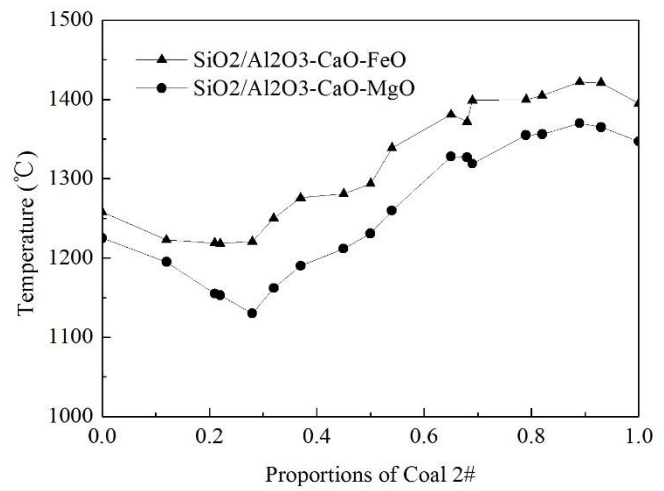
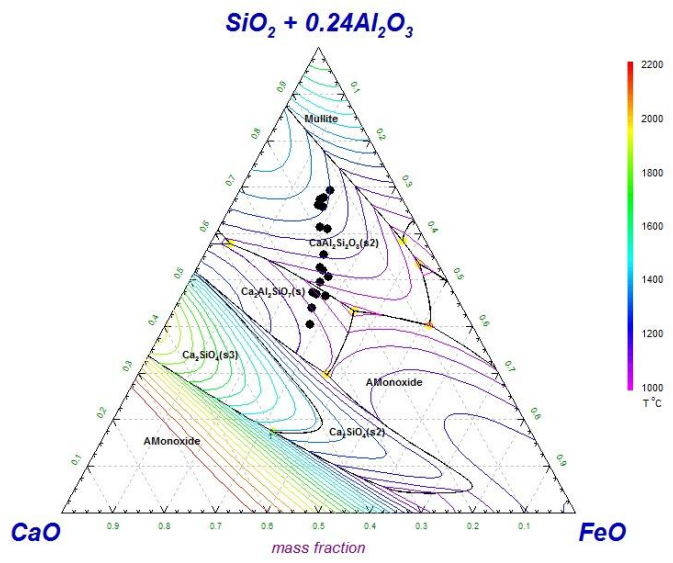
-----Coal blending



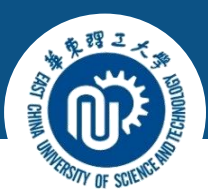
Normal slag



Abnormal slag



Ash/slag liquidus temperature with different blending ratios



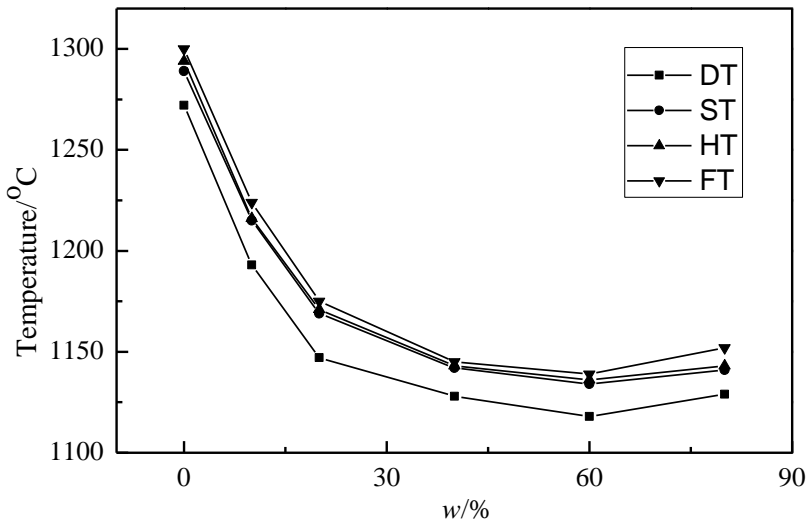
FactSage used for the gasifier operating

Application of FactSage thermodynamic calculation

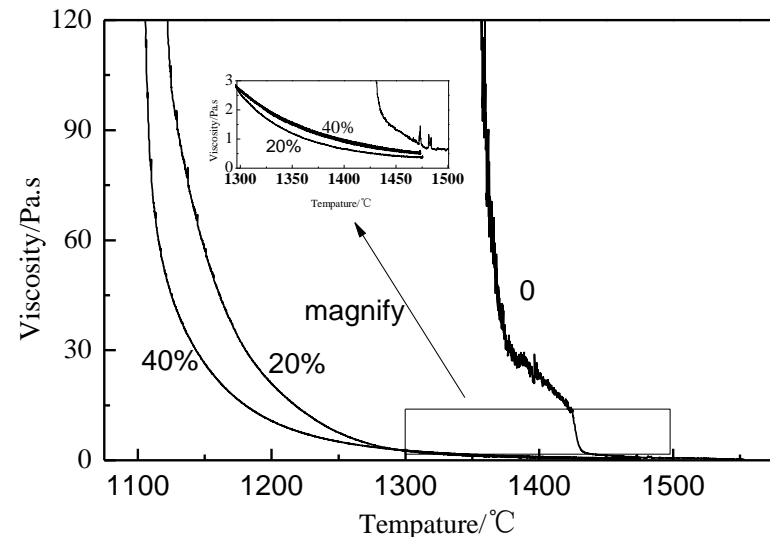
-----Fluxant adding proportion

Change of main composition of coal ash with different ratio sand

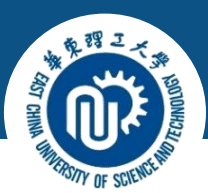
Sand/coal ash w/%	SiO ₂	Al ₂ O ₃	CaO	Fe ₂ O ₃	S/A
0	29.48	18.18	23.73	14.76	1.62
10	33.83	17.60	20.66	13.42	1.92
20	37.44	17.13	18.94	12.30	2.19
40	43.12	16.37	16.24	10.54	2.63
60	47.38	15.81	14.21	9.23	3.00
80	50.69	15.37	12.63	8.20	3.30



Curves of ash fusion temperature with different ratio additive



Viscosity-temperature curve of JJT coal ash



Thanks for your attention!

gqh@ecust.edu.cn