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Central Fuel Research Institute (1946)

Internationally reputed Coal R&D laboratory accredited with ISO 9001: 2000 Certification

Core Competencies

- Resource Quality assessment
- Coal Science
- Coal beneficiation
- Coal Carbonisation
- Coal Combustion
- Coal Gasification
- Coal liquefaction
- EIA and waste management

R&D focus:

- Clean coal initiatives:
  - Coal quality enhancement through preparation & blending
  - Coal Gasification- IGCC, IGFC
  - Oxy Fuel combustion of coal
  - Co- combustion/gasification of coal and biomass
- Specialty chemicals and value added products from coal
- Utilization of weathered coal and advanced method of coke making
- Coal to liquid fuels (CTL & GTL)
- Waste Management
- Coal Bed Methane

Gasification at CFRI

- The core competency of CFRI is on coal science. However, CFRI found a need to establish the relationship among coal characteristics, kinetics and effect of design on gasifier performance.
- CFRI has now taken up a multifaceted gasification program to correlate gasification performance and to develop a methodology for scaling up. These program cover following aspects:
- 1. Setting up 50kg/h PFBG air blown test facility, however, it represents the actual hydrodynamics of large plant.
- 2. To correlate surface characteristics with kinetics of coal gasification using PTGA.
- 3. Once, the testing unit is operational the overall characteristics of coal will be correlated to gasification performance in the testing unit.

It is expected that at the completion of the study CFRI will be in the position to suggest operational parameters of Indian coals and to develop a methodology for scaling up of gasifier for particular coal.

OBJECTIVES OF THE PLANNED TASK ON GASIFICATION KINETICS:

- Characterization of the coal, char and cinders and estimation of active/reactive sites on coal & char.
- Classification of coal based on surface characteristics.
- Study of the kinetics of gasification of low rank coals.
- Mathematical modeling for prediction of composition of gases as a function of operating parameters and properties of coals for gasification reaction.
- Agglomeration formation in reducing condition in pressurized fluidized bed gasification with low rank high ash coals.

Facilities available at CFRI:

- Ultrapycnometer -1000 for true density determination of solids.
- Tristar-3000 for surface area determination of solid samples.
- Auto pore IV 9510 mercury porosimeter to study the pore structure of solids.
- Autochem 2910 for TPD-TPR-TPO study.
- PW 2424 Magix XRF for elemental analysis of solid as well as liquid samples.
- P TGA with EGA facility, the main instrument for Gasification kinetics of low rank coal is under installation and commissioning.
- Setting of PFBG Pilot Plant for agglomeration formation in reducing condition in pressurized fluidized bed gasification with low rank high ash coals.

ROAD MAP : Gasification AT CFRI

- Generation of basic data for kinetics of coal/biomass gasification.
- Clean coal technology in general, particularly for electricity generation in India using IGCC technology is our present goal via gasification of coal/biomass.
- Consultancy support to steel Re-rolling mills through producer gas system utilizing indigenous coal and biomass gasification.
- Production of synthesis gas for chemicals and liquid fuel production; and hydrogen for fuel cell and liquid fuels.

Recent Publications:

- "Fischer-Tropsch synthesis with Co/SiO2-Al2O3 catalyst and steady state modeling using artificial neural network" by B.K.Sharma et al. Fuel 1998;77:1763-1768.
- "Studies on the thermal behaviour of Co/Cu/Al catalyst for higher alcohol synthesis" by B.K.Sharma in CATSYMP-15 & Indo-Pacific Catalysis-2 Symp., 2001 at NCL, Pune.
- "Studies on conversion of synthesis gas to higher alcohols – an alternative for tetraethyl lead" by B.K.Sharma in 16th National Con. of Chem. Eng., 2001 at CFRI,Dhanbad.
- "Studies on cobalt based Fisher-Tropsch catalyst and characterization using SEM and XPS techniques" by B.K.Sharma et al. Applied Catalysis A: General 2001;211:203-211.

contd.

Publications (contd....)

- **"Estimating reactivity of lignite char by Oxygen Chemisorptions for Gasification" by B.K.Sharma and Sujan Saha, proceeding in the International Seminar- Global Coal-2005 (New Delhi).**
- **" Reverse micro emulsion mediated sol-gel synthesis of lithium silicate nanoparticles under ambient conditions: Scope for CO2 sequestration" by R.B.Khomane, B.K.Sharma, S.Saha and B.D.Kulkarni. Chem. Eng. Sci. 2006; 61: 3415-3418.**
- **"Estimation of Gross Calorific Value of Coals using Artificial Neural Networks" by S.U.Patel, B.J.Kumar, Y.P.Badhe, B.K.Sharma, S.Saha, S.Biswas, A.Chaudhury, S.S.Tambe and B.D.Kulkarni. FUEL 2007;86:334-344.**
- **"Density measurements of coal samples by different probe gases and their interrelation"by Sujan Saha, B.K.Sharma, S.Kumar, S.G.Sahu, Y.P.Badhe, S.S.Tambe and B.D.Kulkarni has been accepted in Fuel (7th Nov.2006).**
- **Artificial Intelligence based models for classifying Indian non coking Coals is under preparation.**
- A correlation for prediction of product gases during gasification of high ash Indian coals using steam/air under different operating conditions using ANN concept is under progress and the same prediction will be validated on our system (CFRI & NCL). Under preparation

Know-how for marketing/ consultancy to foreign party: Pilot /semi-commercial / commercial units

- **CFRI, Dhanbad and NCL,Pune have received jointly consultancy work from M/S Adani Energy Limited, Gujrat for preparing a report on " Pre Feasibility Study for coal Gasification Project" .**
- **CFRI was also invited by Project Management Cell, UNDP/GEF Project (Steel), Ministry of Steel, Government of India for selection of appropriate Coal Gasification plant (capacity about 1500 Nm3/hr) and offered a letter for submission of project proposal.**
- **CFRI is also going for development of modular unit for power and fuel in rural areas of Jharkhand in collaboration with IIT, Delhi, ISM, Dhanbad involving private entrepreneurs as partner. The over all project will be supported by Ministry of non conventional energy sources (MNES) New Delhi.**


THANK YOU