

## A Digital Twin model of Coal gasifier for High ash Indian Coal

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Energy and Chemicals are the backbone for development in this modern age and are generally met by Oil & Gas. India being a net importer of Oil is looking towards better utilization of Coal. Coal gasification produces syngas that can further be used in for power generation, production of liquid fuels through FT synthesis and intermediate chemicals like methanol, DME etc. and thus meeting the requirement of New India.

Normally three types of beds are used viz. moving, entrained and fluidized bed gasifier for coal gasification. Among various gasifier types, Fluidised bed gasifier is preferred choice for high ash Indian Coals due to excellent mixing characteristics that allow better carbon conversion. Understanding of Fluidized bed gasifiers requires experimental studies of different scales for various operating scenarios based on the gasification medium viz. steam, air oxygen gas etc.

Recent progression in numerical techniques and computing efficacy has advanced CFD as a widely used computational tool to provide efficient design solutions by modelling the complex physics involved in systems like fluidized bed gasifier.

This paper presents CFD modeling using DDPM and Population Balance models to design a Digital Twin to study combustion and gasification in fluidized beds of high ash Indian Coals. The work highlights the development of digital twin model CFD tool through sub models such as dense bed, dilute bed, cyclone and loop seal system to predict the behavior and the show the capability of model for optimization of design & operation of high ash coal fluidized gasification system.

**Keywords:** Fluidized Bed, Population Balance, Digital Twin. DDPM- Dense Discrete Phase Model, DME-Di Methyl Ether, FT-Fischer Tropsch, CFD-Computational Fluid Dynamics