A study on the engineering optimization for the commercial scale coal gasification plant

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This study was conducted for engineering optimization for the gasification process which is the key factor for success of Taean IGCC gasification plant which has been driven forward under the government support in order to expand to supply new and renewable energy and diminish the burden of the responsibility for the reduction of the greenhouse gas emission. The gasification process consists of coal milling and drying, pressurization and feeding, gasification, quenching and HP syngas cooling, slag removal system, dry flyash removal system, and primary water treatment system. The configuration optimization is essential for the high efficiency and the cost saving. For this purpose, it was designed to have syngas cooler to recover the sensible heat as much as possible from the hot syngas produced from the gasifier which is the dry-feeding and entrained bed slagging type and also applied with the oxygen combustion and the first stage cylindrical upward gas flow. The pressure condition inside of the gasifier is around 40~45Mpg and the temperature condition is up to 1500~1700℃. It was designed for about 70% out of fly ash to be drained out throughout the quenching water in the bottom part of the gasifier as a type of molten slag flowing down on the membrane wall and finally become a byproduct over the slag removal system. The flyash removal system to capture solid particulates is applied with HPHT ceramic candle filter to stand up against the high pressure and temperature. When it comes to the residual tiny particles after the flyash removal system, wet scrubbing system is applied to finally clean up the solids. The washed-up syngas through the wet scrubber will keep around 130~135℃, 40~42Mpg and 250 ppmv of hydrochloric acid(HCl) and hydrofluoric acid(HF) at maximum and it is turned over to the gas treatment system for removing toxic gases out of the syngas to comply with the conditions requested from the gas turbine. The result of this study will be utilized to the detailed engineering, procurement and manufacturing of equipments, and construction for the Taean IGCC plant and furthermore it is the baseline technology applicable for the poly-generation such as coal gasification(SNG) and liquefaction(CTL) to reinforce national energy security and create new business models.

Key words : IGCC(Integrated Gasification Combined Cycle), Coal Gasification(석탄 가스화), Syngas(합성가스), Gasifier(가스화기), HPHT Ceramic Candle Filter(고온고압 세라믹 필터), Wet Scrubber(습식세정기), Poly-generation(복합생산)

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