

Dynamic modeling and simulation of shell coal gasifier

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Shell coal gasification system is Slagging, entrained flow gasifier which has high carbon conversion (>99%) and high efficiency. And it has little byproducts. In this study, one dynamic simulator for shell gasifier is developed for using as a part of IGCC process simulation in gPROMS interface. In addition, the multi-zonal method is used to save the computational expense compared to 3D CFD gasifier model. The gasifier model in the study consists of devolatilization zone (0D), reaction zone (1D), slag zone (1D or 2D), membrane wall zone (1D), quenching zone (0D) and syngas cooling zone (1D). The gasification zone (1D) is modeled as 1D dynamic PFR model of a single-stage, upward-firing, oxygen-blown, dry-fed. For the wall structure, the membrane wall is designed for life of reactor so that the shell gasifier does not need the shutdown for replacement or repairs. The gasifier model developed in this study includes heat transfer phenomena in the slag wall and membrane wall as the corresponding slag zone (1D or 2D) and membrane wall zone (1D). This gasifier model is validated using Shell data.