

Property change of mixing: Steam Gasification

【Module Learning Objectives】

- The ideal-gas mixture model and property changes due to mixing

【Associated Sections in Selected Textbooks】

- Introduction to Chemical Engineering Thermodynamics [1] Sec. 11.4

【Associated Web Modules】

- Steam gasification:

<http://biofuelsacademy.org/web-modules/process/gasification/steam-gasification/>

【Process Background and Problem】

Steam gasification usually refers to a gasification process that uses steam as the gasifying agent. Using this type of gasification method will provide more opportunity for water-gas shift reactions to occur, which may be an upgrade to the type of syngas produced from the fuel used in this process. Fluidization beds are usual applications for this type of process, although other types can be used.

The water-gas shift reaction mentioned above refers to the following reaction, which is one of the most important reactions used to balance the H_2/CO ratio. It provides a source of hydrogen at the expense of carbon monoxide [2,3].

If a stream of steam is added at the rate of $5 \text{ kg}\cdot\text{s}^{-1}$ to a stream of CO with a mass flow rate of $1 \text{ kg}\cdot\text{s}^{-1}$ and they mix adiabatically in a steady-state process. If the gases are assumed ideal, what is the rate of entropy increase as a result of the process?

Bibliography

- [1] J. M. Smith, H. C. Van Ness and M. M. Abbott, Introduction to chemical engineering thermodynamics, Boston: McGraw-Hill; 7th ed., 2005.
- [2] Wikipedia. Fischer–Tropsch process. [Online]. http://en.wikipedia.org/wiki/Fische-Tropsch_process
- [3] Wikipedia. Water-gas shift reaction. [Online]. http://en.wikipedia.org/wiki/Water-gas_shift_reaction