

Coal Gasification for Synthesis Gas Production in an Indirectly Irradiated Packed Bed

Name and Surname :	Piatkowski, Nicolas	Name of PhD's manager(s):	Prof. Aldo Steinfeld
Speciality/ Degree :	Solar Thermochemistry	Laboratory name :	Professorship in Renewable Energy Carriers
PhD starting date :	May 1, 2007	Laboratory address :	ETH Zurich Professorship in Renewable Energy Carriers Institute of Energy Technology Sonneggstr. 3 / ML J 42.1 CH-8092 Zürich

Coal gasification in an indirectly irradiated packed bed is considered. The bed is irradiated from a SiC plate, itself directly irradiated from a source of highly concentrated thermal radiation. The reactor can receive a wide variety of coal sizes and types and allows steam injection through the bed as well as at the upper surface of the bed.

The transient energy equation is solved in one dimension and couples experimentally derived thermo-gravimetric reaction rates and reaction enthalpies with heat transfer. Thermo-physical properties are influenced by local bed temperatures and a changing ash fraction as coal is converted.

Initial model validation was performed through experiments with Beech charcoal and showed good matching for bed temperatures and gasified mass. The upper quarter of the bed achieves temperatures in excess of 1400K very quickly and contributes to the bulk of the gasification. The deeper regions of the bed require a much longer time to reach gasification conditions and therefore mainly undergo pyrolysis. The influence of the ash as an insulating layer drives an increasing temperature and steepness of the temperature profiles in highly converted upper regions of the bed.