PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Gasification Technologies

8/2006

FLUIDIZED BED CHEMICAL LOOPING APPLICATIONS

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Background

Two major impediments to the successful development and commercialization of chemical looping combustion (CLC) are solids-handling problems associated with the huge amounts of metal and metal oxides that must be transported between reactors, and the physical and chemical stresses on the mechanical integrity of the metal/metal oxide particles. Control of solids flow is critical to the success of multi-reactor CLC processes. The goal of this project is to evaluate, develop, and improve designs for chemical-looping process applications using fluidized bed technologies. The project is aimed at assessing and improving measurements of the rate of solids flow between various high-temperature reactor vessels.

Accomplishments

A conceptual design for a scaled Circulating Fluidized Bed (CFB) has been completed. A dual fiber-optic probe was initially applied to measure the solids transfer rate in the packed bed region of the solids recycle leg or standpipe. Unfortunately, using this equipment, the signal-to-noise was inadequate and the packed bed response provided too little texture to track and distinguish average reflected light intensity. An approach to measure and track the coherent image reflected from the packed bed has been adopted. This technique uses an optical sensor to follow the 2-dimensional image of the packed bed as it moves across the field of view. This approach has been demonstrated to be capable of recording the velocity of a moving bed.

COST

Total Project Value
$100k

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1-800-553-7681

WEBSITE

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Benefits

Control of solids flow is critical to multi-reactor coal conversion chemical-looping processes. NETL's current solids-flow device uses an intrusive rotating spiral because it is unsuitable for high temperature applications. This device can provide information to improve cold flow data quality by evaluating the wall effects on the solids flow profile. Existing optical techniques are limited in particle size and/or particle loading, i.e. Laser Doppler Velocimeter (LDV), optical probe. When the probe is completed, process designers and operators will be able to measure, control, and optimize the solids flow in complex chemical looping systems with multiple fluid bed reactors.

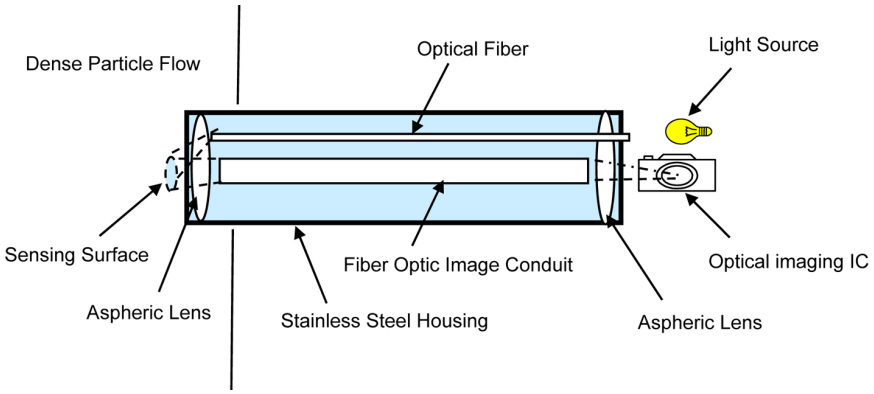

Figure 1. Schematic of optical sensor for solids flow measurement.