17.2 Experimental Study of a High Capacity Rotary Kiln for Oil Shale Processing

Ralph L. Coates, L. Douglas Smoot, Kent E. Hatfield

CRE Energy, Inc., Provo, Utah, United States

In the 27th Oil Shale Symposium we presented a new concept for reducing carbon dioxide emissions from surface processing of oil shale by using simple rotary kilns fired indirectly with hydrogen. We presented mathematical model computations and quotations from commercial kiln vendors indicating that efficiencies and throughput capacities can now be achieved with indirectly-fired rotary kilns that are competitive with directly heated retorts and we noted that experimental verification work should be done.

This paper describes work completed during the past year to acquire, modify and test a pilot-scale rotary kiln with a design capacity of 5 tons of oil shale per day. The kiln is indirectly heated with burners that can utilize both natural gas and hydrogen. The objectives of this phase of our work are to obtain experimental data that will enable us to determine the accuracy of our mathematical model computations and to demonstrate high throughput capacity.

Our model computations show the efficiency of the indirect heating of rotary kilns is dominated by the rate of heat transfer to the solid material in contact with the kiln wall. This paper presents data obtained with inert solids having different particle sizes together with comparison and interpretation of the data with model predictions utilizing previously published heat transfer coefficient correlations.

Following this phase of work we plan to construct and test pilot scale equipment for processing of shale oil produced with this kiln. An important objective will be to evaluate the pyrolysis reaction equations employed in the model.