Title: Dynamic Testing of Gasifier Refractories

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As DOE continues to advance new power systems, materials issues are often pivotal in determining the ultimate efficiency that can be reached in the system. Refractory performance in slagging gasification represents one of these issues. The University of North Dakota (UND) Chemical Engineering Department in conjunction with the UND Energy & Environmental Research Center (EERC) have initiated a program to thoroughly examine the combined chemical (reaction and phase change) and physical (erosion) effects experienced by a variety of refractory materials during both normal operation and thermal cycling under slagging coal gasification conditions. The goal of this work is to devise a mechanism of refractory loss under these conditions.

The focus of the proposed work is to test the corrosion resistance of commercially available refractories to flowing coal slag, and propose the mechanisms of corrosion for the conditions studied. Corrosion is the degradation of material surfaces or grain boundaries by chemical reactions with melts, liquids, or gases, causing loss of material and consequently a decrease in strength of the structure. In order to develop methods of reducing corrosion, the microstructure that is attacked must be identified along with the mechanism and rates of attack. Once these are identified, methods for reducing corrosion rates can be developed.

The work will take advantage of equipment and experimental techniques developed at the EERC under funding from several DOE programs. The controlled-atmospheric dynamic corrodent application furnace (CADCAF) will be utilized to simulate refractory/slag interactions under dynamic conditions that more realistically simulate the environment in a slagging coal gasifier than any of the static tests used previously by refractory manufacturers and researchers.

To date, efforts have focused on final shakedown of the CADCAF and obtaining representative samples of slag and refractory for testing. Experimental work is expected to begin this summer.