

INTERACTION OF MOLTEN SODIUM CARBONATE WITH COAL ASH  
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A fundamental study is being made of the coal ash-melt interactions in relation to gasification of coal in molten sodium carbonate. In the present paper, the interaction of alumina with molten sodium carbonate is discussed. Alumina reacts with molten sodium carbonate to form sodium aluminate ( $\text{NaAlO}_2$ ) and carbon dioxide, i. e.,  $\text{Al}_2\text{O}_3(\text{s}) + \text{Na}_2\text{CO}_3(\text{l}) \rightarrow 2\text{NaAlO}_2(\text{s}) + \text{CO}_2(\text{g})$ . The sodium aluminate formed is very refractory (mp  $>1700^\circ\text{C}$ ) and is only sparingly soluble (10-20 ppm) in molten sodium carbonate. The sodium aluminate forms a protective coating around the unreacted alumina which slows down further reaction with the molten sodium carbonate. The rate of the reaction between  $\text{Al}_2\text{O}_3$  and  $\text{Na}_2\text{CO}_3$  has been examined over the temperature range  $900^\circ$  to  $1100^\circ\text{C}$  under an atmosphere of  $\text{CO}_2$  and with alumina particles ranging in size from  $1\ \mu$  to  $300\ \mu$ . Temperature cycling did not affect the protective nature of the coating of  $\text{NaAlO}_2$  on  $\text{Al}_2\text{O}_3$  even though sodium aluminate is known to undergo a solid phase transition at  $470^\circ\text{C}$ . This was demonstrated in tests in which the temperature was cycled from ambient to  $900^\circ\text{C}$  and in tests in which the temperature was held at  $900^\circ\text{C}$ . Identical rate loss curves were obtained in the two sets of tests.

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