

A study on the performance of an oxygen carrier for oxy-fuel combustion

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The oxygen transport capacity of ilmenite in the oxidation with air and in the reduction with various reducing gases has been determined by thermogravimetric analysis. Ilmenite particles of 20 mg of 0.075 - 0.3 mm in size were heated to the desired temperature of 800 to 900oC and exposed to a sequential alternating atmosphere of reducing and oxidizing gases, and the mass of sample was recorded continuously. The experiment demonstrates that fresh ilmenite reacts faster at reducing gas with H₂ than with CH₄ and CO in the same operating conditions. Increasing the temperature from 800 to 875°C resulted in a significant increase in grain size and increasing the active iron element Fe, however the changes in morphology did not appear to result in any noticeable effect on the oxygen transport capacity of ilmenite. Both fresh and pre-heating ilmenite showed the same weight loss value around 0.08 - 0.1 mg, however it can be observed that the pre-heating sample seems to be more stable during redox cycles. This study provides a basic data for the design and operation of oxy-fuel circulating fluidized bed combustors with oxygen carrier material.