A Study of Cobalt Titanate Perovskite as Oxygen Carrier for Chemical Looping Combustion

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The CO_2 was designated to have the highest contribution for global warming due to high emissions. CLC(chemical looping combustion) was inherent CCS(carbon capture and storage) [1]. In a chemical looping combustor, the oxygen carrier is an important medium for supplying oxygen required for the reaction and transferring heat [2]. It is well known that the perovskite groups maintain the stable crystal structure and can show the activity for specific reaction with higher thermal stability [3]. Therefore, selected $CoTiO_3$ perovskite was investigated as oxygen carrier.

The cyclic reduction and oxidation reaction were performed in TGA equipment. When the $CoTiO_3$ particles were reduced using 15% H_2/N_2 and, Oxygen transfer capacity was 10.2% for 10 cycles for 15% H_2/N_2 and 10.2% at the first cycle and gradually increased for 15% CH_4/N_2 (Fig.1). It was similar to the theoretical oxygen transfer capacity (10.3%). With 15% H_2/N_2, maximum oxygen transfer rate was 0.015 mmol O_2/g/sec. For 15% CH_4/N_2, it was 0.03 mmol O_2/g/sec which was twice higher as shown in Fig. 3. However, oxygen transfer rate in air oxidation was 0.052 mmol O_2/g/sec when using 15% H_2/N_2 as reducing gas. Overall reducing and oxidizing reactivity was maintained with cycles and more active reducibility was observed with 15% CH_4/N_2. From the results, $CoTiO_3$ has potential as oxygen carrier.

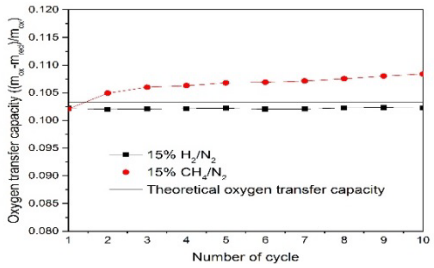

Fig.1 Oxygen capacity as a function of number of cycle using 15% H_2/N_2, CH_4/N_2 as reducing gas and air as oxidizing gas.

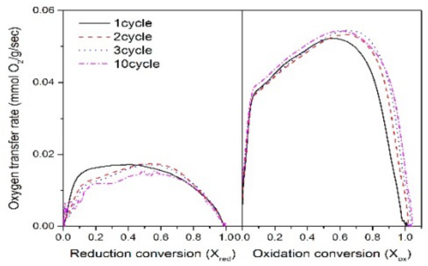

Fig.2 Oxygen transfer rate as a function of conversion using 15% H_2/N_2 as reducing gas and air as oxidizing gas.

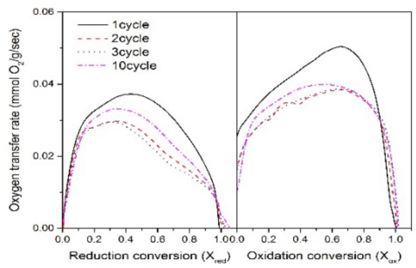

Fig.3 Oxygen transfer rate as a function of conversion using 15% CH_4/N_2 as reducing gas and air as oxidizing gas.

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