Study on the effect of natural minerals on the product gas composition from gasification of lignite under co-feeding of steam and CO_2

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Coal Gasification has been investigated all over the world to develop innovative and eco-friendly technologies that could reduce the emission of environmental pollutant. Most attention on coal gasification have been paid to with either steam or CO_2 atmosphere [1]. And, many gasification studies are performed in a fluidized bed reactor, where bed materials are mixed with the catalyst to improve the reactivity of the fluidized bed reactor [2].

In this study, the effect of natural minerals addition was investigated when gasification was carried out with steam and CO_2 mixture.

The dolomite and kaolin were used as natural minerals. 5 wt % of natural mineral was physically mixed with lignite. Steam and CO_2 mixed gasification reaction system was carried out with micro quartz reactor at various temperatures of 900 °C. The product gases were analyzed continuously with gas analyzer and gas chromatography.

Table 1 shows the total moles of H_2, CO, and CO_2 produced and the carbon conversion at 900 °C.

As the composition of CO_2 in the reaction gas increased, the amount of product gas CO_2 decreased and the value of (H_2 + CO) / CO_2 increased.

When comparing the values of (H_2 + CO) / CO_2 of the syngas produced in the same reaction gas composition, the highest except for steam 300 CC/min were shown with Dolomite 5 wt%.

Fig. 1 shows the gas production profile over time according to each reaction gas conditions at 900 °C. The time to reach the carbon conversion of 80 % was 8 to 14 minutes. Especially, when CO_2 100 cc/min + steam 200 cc/min was used as the reaction gas, the gasification reaction was terminated at the fastest.

As a result, the amount of H_2 increased when the composition of steam was increased in the reaction gas, and the fastest gasification reaction was observed when CO_2 100 cc/min + steam 200 cc/min was used as the reaction gas.

	H_2 (mmol)	CO (mmol)	CO_2 (mmol)	H_2+CO / CO_2	Carbon conversion (%)	H_2 (mmol)	CO (mmol)	CO_2 (mmol)	H_2+CO / CO_2	Carbon conversion (%)
No Catalyst	Steam 300 cc/min					CO_2 100 cc/min + Steam 200 cc/min				
	13.51	4.48	11.41	**1.58**	89.5	10.2	6.03	10.53	**1.54**	92.55
	CO_2 200 cc/min + Steam 100 cc/min					CO_2 300 cc/min				
	5.84	10.45	5.79	**2.81**	90.81	0	13.06	2.76	**4.73**	89.59
Dolomite 5 wt%	Steam 300 cc/min					CO_2 100 cc/min + Steam 200 cc/min				
	14.13	4.75	12.53	**1.51**	93.15	11.1	6.42	10.85	**1.61**	95.54
	CO_2 200 cc/min + Steam 100 cc/min					CO_2 300 cc/min				
	6.11	10.79	5.83	**2.90**	92.69	0	13.57	2.86	**4.74**	92.05
Kaolin 5 wt%	Steam 300 cc/min					CO_2 100 cc/min + Steam 200 cc/min				
	13.83	4.01	12.31	**1.45**	91.53	10.98	6.02	10.53	**1.61**	93.78
	CO_2 200 cc/min + Steam 100 cc/min					CO_2 300 cc/min				
	6.02	10.79	6.13	**2.74**	91.72	0	13.34	3.18	**4.19**	90.65

Table 1 Total yields of major product gases

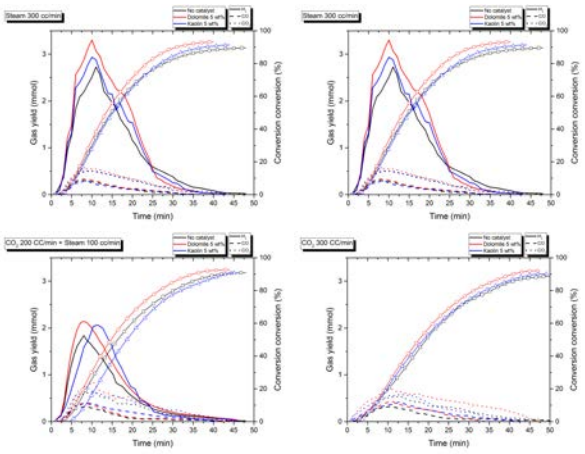

Fig. 1 Graph of Time vs Gas production

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