Potassium Capture by Kaolin, Part 1: KOH - DTU Orbit (02/12/2018)

Potassium Capture by Kaolin, Part 1: KOH

The reaction of gaseous KOH with kaolin and mullite powder under suspension-fired conditions was studied by entrained flow reactor (EFR) experiments. A water-based slurry containing kaolin/mullite and KOH was fed into the reactor and the reacted solid samples were analyzed to quantify the K-capture level. The effect of reaction temperature, K-concentration in the flue gas, and, thereby, molar ratio of K/(Al+Si) in reactants, gas residence time, and solid particle size on K-capture reaction was systematically investigated. Corresponding equilibrium calculations were conducted with FactSage 7.0. The experimental results showed that kaolin reached almost full conversion to K-aluminosilicates under suspension-fired conditions at 1100–1450 °C for a residence time of 1.2 s and a particle size of D_{50} = 5.47 μm. The amount of potassium captured by kaolin generally followed the equilibrium at temperatures above 1100 °C, but lower conversion was observed at 800 and 900 °C. Crystalline kaliophilite (KAlSiO₄) was formed at higher temperatures (1300 and 1450 °C), whereas, amorphous K-aluminosilicate was formed at lower temperatures. Coarse kaolin (D_{50} = 13.48 μm) captured KOH less effectively than normal (D_{50} = 5.47 μm) and fine (D_{50} = 3.51 μm) kaolin powder at 1100 and 1300 °C. The difference was less significant at 900 °C. Mullite generated from kaolin captured KOH less effectively than kaolin at temperatures below 1100 °C. However, at 1300 and 1450 °C, the amount of potassium captured by mullite became comparable to that of kaolin.

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, CHEC Research Centre, Ørsted Bioenergy & Thermal Power
Pages: 1851–1862
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Energy and Fuels
Volume: 32
Issue number: 2
ISSN (Print): 0887-0624
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.55
Web of Science (2017): Impact factor 3.024
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.49
Web of Science (2016): Impact factor 3.091
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.34
Web of Science (2015): Impact factor 2.835
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.3
Web of Science (2014): Impact factor 2.79
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.52
Web of Science (2013): Impact factor 2.733
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.25
Web of Science (2012): Impact factor 2.853
ISI indexed (2012): ISI indexed yes