

# The Promotive Properties of Alkali Metal Nitrate Melts for the Partial Oxidation of Methane to Methanol

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Z. Naturforsch. **53b**, 249-255 (1998); received October 7, 1997

Partial Oxidation, Conversion, Selectivity, Molten Salt, Reduced Oxygen Species

(Na, K)NO<sub>3</sub> melts of various ratios were used as promoters for the partial oxidation of methane to methanol. Experiments were performed in a flow reactor system under atmospheric pressure and at various temperatures in the range of 525-600 °C. The influence of reaction temperature, melt composition, and reduced oxygen species on methane conversion and methanol selectivity were investigated systematically. The major reaction products were CH<sub>3</sub>OH, CO, CO<sub>2</sub>, and trace amounts of C<sub>2</sub>H<sub>6</sub> and C<sub>2</sub>H<sub>4</sub>. A methane conversion of 1.8-12.4% and a methanol selectivity of 0.4-14.1% were obtained under these reaction conditions. Binary melts could achieve higher methanol selectivity than a single melt. The amounts of reduced oxygen species O<sub>2</sub><sup>-</sup> and O<sub>2</sub><sup>2-</sup> were estimated from thermochemical data according to the ion equilibrium in molten nitrates. The promotive effect of nitrate melts was confirmed and the results indicate that superoxide O<sub>2</sub><sup>-</sup> plays an important role for methanol formation.

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