Environmental Engineering and Management Journal

March 2012, Vol.11, No. 3, 661-667
http://omicron.ch.tuiasi.ro/EEMJ/

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BEHAVIOUR OF ALKALINE-EARTH METAL NITRATE – FUEL BINARY MIXTURES IN SOLUTION COMBUSTION SYNTHESIS

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Abstract

The results of a systematic study concerning the behavior of alkaline-earth metal nitrate $M(NO_3)_2$ (M^{2+} = Be^{2+}, Mg^{2+}, Ca^{2+}, Sr^{2+} and Ba^{2+}) fuel mixtures are reported. Three of the most frequently used fuels have been tested: urea, glycine and β-alanine. Thermal analysis was used in order to investigate the behavior of individual metal nitrates and fuels. The major difference in terms of thermal behavior of the individual metal nitrates is also reflected in the behavior of metal nitrate – fuel binary mixtures. In all cases, the ignition of the combustion process was performed at 400°C. Beryllium nitrate did not generate a typical combustion process with urea, while β-alanine and glycine triggered a low intensity combustion process. Magnesium nitrate and calcium nitrate reacted very energetically with β-alanine. Strontium nitrate and barium nitrate generated low intensity combustion reactions with β-alanine, leading to the formation of metal carbonate and unreacted metal nitrate. The phase composition of the samples was investigated by X-ray diffraction. The results reported hereby show the importance of a rational fuel selection, especially when the preparation of mixed metal oxides is aimed and mixtures of metal nitrates are used. In the case of alkaline-earth metal oxides, experimental results evidenced that urea is not a suitable fuel for $Be(NO_3)_2$; β-alanine is an adequate fuel for magnesium nitrate and calcium nitrate; none of the three fuels triggered a vigorous combustion process with strontium nitrate or barium nitrate.

Key words: combustion synthesis, thermal analysis, X-ray diffraction

Received: April, 2011; Revised final: September, 2011; Accepted: September, 2011

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