INFLUENCE OF CARBON NANOTUBES ON THE COMBUSTION LAWS OF LOW-CALORIE PROPELLANT

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Abstract: Influence of carbon nanotubes (CNT) and, for comparison, soot on the catalytic action of nickel carbonate ($NiCO_3$) on combustion of low-calorie propellant with $Q_l = 2518$ kJ/kg was investigated. The structure and the composition of the quenched samples of the propellant without additives, with 3% $NiCO_3$, and in combination with 1.5% of soot and CNT at 2-megapascal pressure were investigated with use of electron-probe analysis. It was determined that there are the same laws in combustion of low-calorie propellant with $NiCO_3$ and with various carbon materials as for the mean- and high-calorie propellants with copper-lead catalyst. Propellant combustion catalysis is taken place only when a developed carbon frame is being forming on the combustion surface, where significant amount of catalyst particles is accumulated. Carbon nanotubes much more increase the action of $NiCO_3$ than soot thanks to stronger frame on the combustion surface. Since the frame on combustion surface is containing large (up to ~ 43 %(mass.)) amount of metal, one can assume that its heat conductivity (λ^*) will be much higher than for the gas. Amount of heat conducting from the gas to the condensed phase significantly increases. That is why, the leading combustion zone of the catalyzed propellants is the zone above the combustion surface against the propellant without additives.

Keywords: double-base propellant; combustion catalysts; combustion leading zone; electron microscope; X-ray electron-probe microanalysis

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