CHARGES BASED ON METAL POWDERS FOR A CLOSED TYPE THERMOELECTRIC GENERATOR

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Abstract: The possibility of development of charges on the base of powdered metal, magnesium and aluminum, for thermoelectric modules of pulsed closed-type electricity generators is considered. The chemical energy is converted into electricity when the charges are burned in air. The possibility to organize the effective diffusion combustion of large diameter charges in the regime of natural diffusion of an oxidizer is demonstrated. As for magnesium, it involves the use of combustion promoters. It is shown that complete combustion of the charge occurs without any combustion promoter with a special charge design in which the oxidant is supplied to the metal body with natural diffusion through special channels in the body. The excess nitrogen amount that reacts with the PAP-2 aluminum and the mass fraction of nitride in the combustion products have been estimated.

Keywords: thermoelectric generator; metal burning; magnesium; diffusion combustion

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Figure Captions

Figure 1 Dependence of the surface combustion rate (*a*) and combustion completeness (*b*) on the sample diameter

Figure 2 Combustion of the powdered magnesium sample with 5 %(wt.) Fe_2O_3 additive: (*a*) primary combustion wave; and (*b*) secondary high-temperature combustion wave

Figure 3 Records of thermocouples at combustion of powdered magnesium sample with 5 %(wt.) Fe_2O_3 additive

Figure 4 Schemes of channel charges: (*a*) with annular channel; (*b*) a composite charge; and (*c*) with cylindrical channels

Figure 5 The PAP-2 powder sample after burning in air: (*a*) a rectangular charge frame; (*b*) a cavity inside the frame; and (*c*) a cavity inside the bulk cone with the $\sim$ 30-millimeter base

Figure 6 The nitrogen excess coefficient for reaction of aluminum with air as a function of the relative alumina mass in the powder. The dotted line corresponds to the proportional use of both air oxygen and nitrogen

Table Captions

Table 1 Specific heats of combustion for metals

Table 2 Combustion parameters of powdered magnesium samples

Table 3 Combustion parameters of charges with annular channel

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