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Electroerosion dispersion-prepared nano- and submicrometre-sized aluminium and alumina powders as power-accumulating substances

ABSTRACT. The nano- and submicrometre aluminium powders prepared by electroerosion dispersion (EED, which consists in dispersing a granulated metal by electric discharges) can be used as power-accumulating substances (PAS) able to produce hydrogen using their reaction with water in the presence of caustic alkali. The spherical shape and polydisperse composition of Al powders consisting of nano- and submicrometre particles (from 0.05 to 5 μm) allow dense packing of the PAS (1240 kg/m^3) and provide the possibility to produce 1.5252 m^3 (at 1 atm) of hydrogen from 10^{-3} m^3 of PAS. The presence of a nanosized fraction ensures a short induction period of the reaction with water and a high rate of hydrogen release. The polydisperse composition of the powders is responsible for the constant reaction rate. The aluminium oxide (Al_2O_3) powders, which are the products of the reaction with water, can be used as polishing powder, for manufacturing ceramic materials, or can be reduced back to aluminium. EED-produced amorphous Al_2O_3 with grains of size 5–100 nm can be used to store hydrogen (due to occlusion of hydrogen in the alumina) and thus can also be considered as a PAS.

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