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Mechanical activation of the surface of aluminum powders and regularities of their hydrolysis

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In the present work, aluminum powders of PA-4 and ASD-1 grades were activated with eutectic alloy Ga-In-Sn (5 wt.%) by grinding in a planetary mill (Fritsch Pulverisette P6 mill with steel balls, 400 rpm for 1 hour [PA-4] or for 4 hours [ASD-1]) or in a ceramic mortar manually. In a planetary mill only part of the powders formed a lump adhered to the wall of the mill. It was found by means of EVO 40XVP scanning electron microscope with INCA Energy microanalysis system that these lumps were enriched with eutectic alloy (5 wt.%) localized on the surface of aluminum grains (see Fig. 1).

Regularities of the hydrolysis of obtained powders were studied by periodic determining the volume of hydrogen released during hydrolysis in a volumetric setup at 25 °C. After bringing hydrogen volumes to normal conditions the dependences of hydrogen volume on hydrolysis duration were obtained (see Fig. 2).

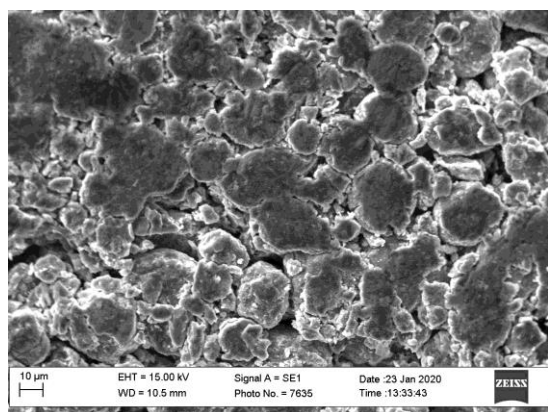


Fig. 1. SEM micrograph of ASD-1 powder activated in a planetary mill and formed lump

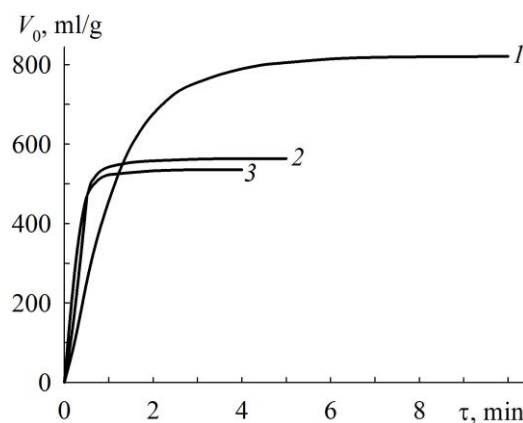


Fig. 2. Dependences of hydrogen volume on the duration of hydrolysis of following powders: 1 – PA-4 activated in mortar; 2 – ASD-1 activated in mortar; 3 – PA-4 activated in mill

From Fig. 2 it follows, that aluminum powders activated in a planetary mill and formed lumps reacted with water faster than a powder activated in a mortar, but the hydrogen yield during hydrolysis of the latter powder was higher than during hydrolysis of the powders formed lumps in the mill.