NANOPOWDERS PRODUCTION OF AL BY ELECTRICAL EXPLOSION OF WIRES

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Metalpowdersnowadays are in usage in additive technologies, theyplayroleof “rawmaterials” in 3Dprinting.

Main ways of metal powders obtaining are: plasma dispersion, gas atomization, centrifugal dispersion, etc., each method has itis own advantages and disadvantages.

Electrical explosion of wires (EEW) allows to obtain sphere shaped particles which find their application in 3D printing.

The main advantage of this method is simplicity and universality of the equipment, low energy consumption and possibility of receivable product’s structure and size regulation.

In currentwork it is shown that it is possible to change the particle sizes of aluminum wires obtained by the electric explosion method by adjusting the energy level introduced into the conductor during an explosion, and also changing of structure of the gas environment in which EEW is carried out.

It is established that the powders received in the EEW modes with the low level of the energy injected into the wire – $0.4e_s$ (e_s – specific energy of sublimation of aluminum 32.9 J/mm^3) in the environment of argon consist at least of three fractions.

The average size of the first fraction - large fraction is 30 microns (figure 1, a), her entrance is about 55%,the second fraction consists of particles from 2 to 6 microns.The average size of the third one is nanometers,40 nm.

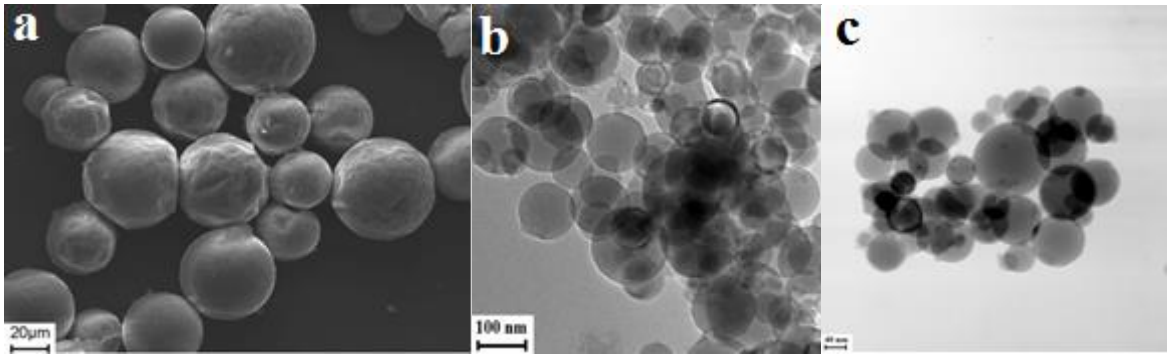

Figure 1. Photos of Al of the powders received at various levels of energy.
a) Ar - $0,4e_s$; b) Ar - $1,9e_s$;c) He – $1,9e_s$.

Increasing of energy up to $1.9e_s$, at EEW in argon leads to "disappearance" of micron fraction of particles and reduction of the average size of particles of nanometer fraction up to 30 – 300 nanometers with a maximum at 110 nanometers (figure 1, b).

EEW in the environment of helium at energy of $1.9e_s$ allows to receive powders with the largest specific surfacearea –upto 20 m^2/g, with the narrow histogram of particles size distribution and with the average size about 80 nanometers (figure 1, c).

With reduction of the size of particles also the content of metal aluminum in them decreases.It is caused by increase in their reactionary activity.Particles with an average size of 30 microns at 99% consist also metal. Particles with an average size of 400 nanometers contain – 93% of Al, and in powders with a size of particles about 100 nanometers the content of metal is about 87%.

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