PRODUCTION OF THE MICRON POWDERS BY THE ELECTRIC EXPLOSION OF METALLIC FIBERS [1]

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Nowadays the electric explosion [1] is under consideration as a prospective method for the production of micron metal powders. The explosion is executed by the "slow" energy input from a charged capacity C_0 into a metal fiber (with a resistance of R_0) produced by the method [2]. That condition can be expressed [3] as

$$\tau_d >> \tau_{MHD}, \quad (1)$$

where $\tau_d \sim R_0C_0$ is the time constant of the circuit and $\tau_{MHD} \approx 0.2...1.4$ μs is the characteristic time of the magnetohydrodynamic MHD instabilities.

Experimental studies were performed in a chamber in an inert argon atmosphere (with pressure of ≈1 atm). The circuit included a C_0 =0.6 μF capacitor, a charger and a high performance thyratron (Pulsethech Ltd) with an igniter. A titanium fiber (with an average diameter of 20…50 μm) was as the resistance R_0 and the raw material. The charger allowed to the capacitor charging up to a voltage U_0 from 2.5 to 5.0 kV. The current and voltage dynamics were measured by a Rogovsky belt and a voltage divider. The explosion products collected inside a quartz tube were characterized by SEM, EDX and optical microscopy.

The measuring of the current and voltage dynamics indicated that the characteristic current amplitudes I_{max} were about ≈40…70 A. The typical τ_d were about ≈40…100 μs. So the condition (1) was fulfilled at the studies. The produced titanium particles (see Fig. 1) had a spherical shape with an average diameter from 80 to 170 μm. A purity of the particles was varied from 97.32 to 99.63 % as for the raw fibers. Oxygen was not detected.

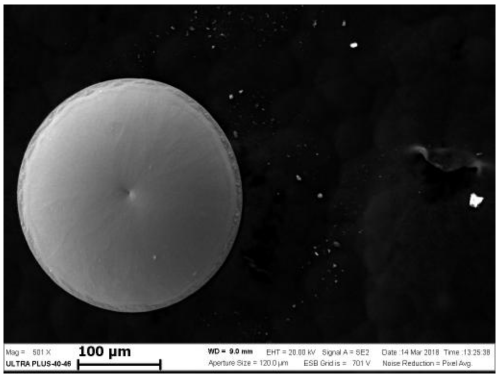

Fig. 1. The typical produced Ti particle

The "slow" (with $\tau_d \approx 40...100$ μs) electric explosion in an inert atmosphere is perspective for the production of metallic particles from the fibers. The energy consumption is about 0.5…1.0 kW·hour per 1 kg of Ti particles. The using of the micron titanium particles are under consideration for different applications, such as a catalyst, a raw for additive manufacturing etc.

REFERENCES

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