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SYNTHESIS OF ULTRAFINE PARTICLES OF COPPER AND ZINC OXIDES UNDER THE ACTION OF LOW TEMPERATURE GAS DISCHARGE PLASMA *)

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Metal and metal oxide nanoparticles have recently attracted attention as one of the most important materials due to their improved properties, and these materials have been widely applied in various fields such as electronic devices [1] and catalysis [2]. There are many approaches to the implementation of the production of such materials, based on various chemical and physical methods [3]. In recent years, there has been a trend towards the use of gas-discharge plasma for the synthesis of nanoparticles. In this case, to implement the process at atmospheric pressure, arc discharges are mainly used. Due to the complexity of the implementation process, it is often difficult to control the size and composition of the resulting particles.

We propose a new approach to obtaining ultrafine materials based on the use of low-temperature plasma of a glow discharge. The installation was a quartz tube (height 8 cm) the bottom of which was made of stainless steel with holes of the order of 0.5 mm, through which air was supplied at a speed of 5 l/min. The bottom of the cell served as the cathode. The top of the tube was closed with a fluoroplastic cap with a hole for a titanium anode. The interelectrode distance was 5 mm. Discharge current 50 mA. The discharge burning time was 5 minutes. Crystal hydrates of copper and zinc nitrates were poured onto the cathode. The resulting particles were washed off from all elements of the cell with distilled water into a beaker and then dried at a temperature of 50°C until the water completely evaporated.

The appearance of the particles and their elemental composition were determined using scanning electron microscopy (SEM, Tescan Vega 3SBH, Czech Republic) with an energy dispersive X-ray spectral analysis system (Aztec EDS, Oxford Instruments Ltd., England). Analysis showed that the resulting substances are oxides with a complex and well-developed surface morphology. In the case of using copper nitrate, we obtain copper oxide CuO; using zinc nitrate, the output is zinc oxide ZnO. Experiments were also carried out using a mixture of 1 mole of zinc nitrate and 1 mole of copper nitrate. The result was double oxide CuOZnO.

In conclusion, copper oxide, zinc oxide, and double oxide CuOZnO particles were obtained from copper and zinc nitrates, respectively, using air glow discharge. The particles have a well-developed surface, which makes them potentially useful as catalysts.

References

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