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RESEARCH OF REGULARITIES OF ELECTROREDUCTION OF NICKEL POWDERS AT POLARIZATION BY THE CATHODIC IMPULSE CURRENT IN THE ULTRASONIC FIELD

Abstract. The process of formation of nickel powders by the electrochemical method has beeninvestigated. The regularity of electroreduction of nickel at polarization by cathodicimpulse current in an ultrasonic field (frequency 35 kHz) is studied. Under these conditions, the effect of the titanium current density on the reduction of nickel ions has been investigated. It is shown that, depending on the current density values, nickel coatings or powders of gray or black color may be produced. At low current densities of the titanium electrode, the nickel powders of gray color and a metal coating are formed. At high current densities of the titanium electrode, black powders are formed. It is established that the total current output of nickel powders and coatings is 83.5%. The effect of the nickel current density on the current output of the formation of its powder has been investigated. It is shown that the maximum current output (64.4%) is observed at a current density of 1000 A/m^2 on nickel. Photomicrographs of the obtained powders and coatings of nickel have beenmade. It is shown that the formed powders consist of dendritic and globular particles. The effect of the concentration of the solution ($NiSO_4 \cdot 6H_2O$+NaCl) on the current output ofnickel recovery has been investigated. It was found that with increasing of $NiSO_4 \cdot 6H_2O$ concentration from 1 to 20 g/l, the current output of nickel powder formation increases from 7.47 to 46.6%. With increasing of concentration of sodium chloride, the current output of nickel powder formation also increases.
Keywords: electrochemistry, nickel, powder, reduction, cathode, impulse, ultrasound, polarization, microphotograph, frequency.

The growing interest in metallic nickel and its powders is due to the continuous increase in the consumption of this metal in new fields of technology [1-5]. Nickel, as a cheaper metal than palladium and platinum, is widely used as a catalyst in hydrogenation processes [6-8]. For these purposes, it is reasonably to use nickel in the form of a powder. Powdered nickel is also consumed in the production of nickel alloys and as a binder in the manufacture of solid and supersolid materials [9]. Nickel electrodes made of the finest powders are also used in fuel cells.

There are a lot of methods for obtaining metallic powders. Such methods are atomization, restitution in the combustion regime, and others [10, 11]. However, all of them are multi-stage, labor-intensive and sometimes expensive. Therefore, the development of new alternative, more economical and simple methods for producing metallic powders is of great interest.

The production of nickel powders by the electrochemical method has a number of advantages such as minimal energy (the process is carried out at room temperature), and other costs (the use of readily