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Electrolytic Preparation of Iron Powder with Particle Size Less than 106 μm

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Abstract

Avery large numbers of articles are made by powder metallurgical methods using electrolytically reduced metal powders. Iron powder is one of these powders which play an important role in this field. Its preparation by electrolytic method is economic in comparison with the traditional methods (Atomization and carbonyl processes).

An electrochemical cell consisting of two electrodes (stainless steel cathode and iron anode, 99.9%) was used to study the electrolytic preparation of iron powder with particle size less than 106μm directly as powdery form. Ferrous sulphate electrolyte was used containing sodium chloride as a stabilizing agent. The produced powder was thoroughly washed with an acidified distilled water and absolute ethanol, then dried under an inert atmosphere at 80oC, and classified by screening. Samples of prepared powder were taken to determine their purity by atomic absorption. The effects of current density, metal ion concentration, sodium chloride concentration, PH, and electrolysis time on the weight percent of iron powder less than (106μm), yield and current efficiency were studied.

It was found that an iron powder with particle size less than 106μm can be prepared at a weight percent of iron powder less than 106μm (89.7%) and current efficiency of 71% using cathodic current density of 0.1 A/cm^2 and electrolysis time equal to 1 hr. The prepared powder having an apparent density of (3.24 gm/cm^3 and real density of 7.39 gm/cm^3 with specific surface area of 238 X 103 cm^2/gm. Its average particle size was 75 μm and its purity was 99.14%.

Keywords: iron powder, electrolytic iron, electrodeposition of iron, electrolytic preparation.

Introduction

Iron powder plays an important role in the industry, it accounts for 80% by weight of all metal powders produced annually [1].It is used extensively in the manufacturing of various automobile sintered parts and electromagnetic materials such as: the dust core, oxygen absorber and body warmer by using powder metallurgy (P/M) technique which is the most diverse manufacturing approach among the various metal working technologies due to its ability to fabricate high quality and complex parts to close to tolerances in an economical manner. Iron powder is also used as a carrier for toner in electrostatic copying machines and a chemical raw material to recover metals of value in the process effluent [2].

Iron powder are manufactured through several different methods of production with each yielding a product that has distinct physical properties, four principal methods by which iron powders are commercially produced: Atomization, Chemical reduction, Thermal reduction and electrolytic method. Atomization is the oldest method and still dominant for producing iron powders although it requires high energy. The chemical method has also been used where selected ore is crushed ,mixed with carbon and passed through a continuous furnace where reaction takes place leaving a cake of spongy iron which is then further treated by crushing .since no refining operation is involved ,the purity of the product depends on that of the raw materials. Carbonyl process was originally developed