ADVANCES IN MATERIALS ENGINEERING

Volume 1

Edited By:
Zahurin Halim
Iskandar Idris Yaacob
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Chapter 031

Pulsed Electrodeposition

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Keywords: Pulsed electrodeposition, pulsed current, pulsed plating.

Abstract. Pulsed electrodeposition is the deposition of metals or alloys onto a metallic substrate by the application of pulsed current. Pulsed current can be formed by introducing current waveform into direct current. Thus the pulse technique can alter the potential or the current with time. There are several advantages to the use of pulsed current. First, by the use of the pulsed current it is possible to produce deposits at electrode potentials and current densities which would not be possible with the use of direct current due to mass transport limitations. Secondly, the deposits produced by pulsed electrodeposition could have different properties from those produced by direct current. Thirdly, by the use of pulsed current, composition can be altered by selecting the correct pulse parameters since deposit composition is affected by the electrode potential.

Introduction

Pulsed electrodeposition, known also as pulsed plating, is the electrodeposition of metals or alloys onto a metallic substrate by the application of pulsed current. Pulsed current can be formed by introducing any deviation of the current waveform from direct current. Thus the pulse technique can alter the potential or the current with time. By the use of the pulsed current it is possible to produce deposits at electrode potentials and current densities which would not be possible with the use of direct current due to mass transport limitations. This can be done by applying a suitable waveform. The other is the deposits produced by pulsed electrodeposition could have different properties from those produced by direct current. By the use of pulsed current, composition of deposit can be altered by selecting the correct pulse parameters.

Pulsed Current. Pulsed current waveforms can be programmed to meet the requirement of a specific type of electrodeposition. By using modern pulsed plating rectifiers which allow very short or very long pulses to be applied with either cathodic or anodic polarity, great flexibility in programming current waveform can be achieved. Pulsed current can be programmed to form very complex waveforms. Current waveforms can be divided into two major groups, unipolar pulses, where all the pulses are in one direction, and bipolar pulses where anodic and cathodic pulses are mixed. These two major groups can be divided further into superimposed pulses, duplex pulses, etc as shown in Fig. 31.1. However, as the complexity of the applied waveform increases the number of parameters required to characterize the waveform also increases. This makes it difficult to understand how a particular waveform is affecting the electrodeposition process. For this reason the waveform used in the present study is a simple unipolar pulse as shown in Fig. 2.