

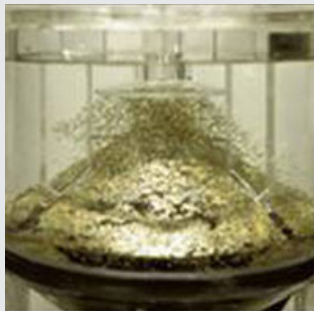


Guide to
Spouted Bed Electrode (SBE) Plating

Introduction

In this day and age, most of us have mobile phones, MP3 players, or a combination of the two. Do you remember your first cell phone or portable MP3 player, particularly its size and weight? Early mobile phones and digital music players were clunky, heavy, and barely fit into a shirt or suit pocket. Now, however, they are small, sleek, and weigh very little. Everything in these devices is smaller, including speakers, microphones, disk drives, batteries, and connectors. This improvement is a result of miniaturization, or the trend to manufacture increasingly smaller mechanical, optical, and electronic products and devices.

This mega-trend is growing very rapidly in our society, and it shows no sign of slowing as consumer electronics, medical devices, and scientific instrumentation continue to get smaller and smaller. Miniaturization in the electronics and semiconductor industries has led to the emergence of discrete micro-sized components such as headers, connector clips, chip capacitors, resistors, varistors, and inductors.



Traditional Electroplating

Like their larger predecessors, these small components often require electroplating as a finishing step to impart corrosion protection, wear resistance, conductivity, and solderability characteristics. But because the size of these components has been reduced so significantly in recent years, conventional electroplating equipment technologies are no longer fully suitable for this purpose. In fact, some have opined that standard electroplating of these components is among the primary roadblocks standing in the way of increasing miniaturization.

In traditional electroplating, an electrolytic cell – which includes two electrodes, electrolyte, and an external source of current – is used to deposit a metal coating on a solid substrate. The process is designed to alter the surface properties of an object for the purposes of abrasion and wear resistance, corrosion protection, lubricity, aesthetics, or to increase the thickness of undersized parts. Barrel plating, in which objects are tumbled in a perforated horizontal rotating drum, is a common method of electroplating small parts. Many very small parts, however, cannot be plated effectively in a barrel due to poor contact with the current feeder or fouling on the interior of the drum. These problems often necessitate the addition of plating media (typically some type of smooth metal shot) to the barrel to improve cathodic contact and part motion.

The use of media significantly increases the required plating time and current because the media is also plated and therefore, the plating cost per part is increased. Additionally, many small parts are fragile and may be damaged by tumbling with heavy media. Finally, small parts can interlock, nest, or couple, which can result in defective or uneven plating. Uneven plating is an anathema in an industry that relies on the integrity of plating for consistent and uninterrupted connectivity. Consequently, these parts cannot be plated successfully in barrels.



Spouted Bed Electrode (SBE) Plating

Recently, a new plating technology arrived on the scene for the specific purpose of plating small parts, flat parts, parts with counter bores, parts with tabs, parts that nest, or parts that simply have difficult geometries: spouted bed electrode (SBE) plating. Designed for parts with dimensions smaller than 1 cm in any single dimension, SBE is suitable for plating parts that are difficult to plate in traditional equipment, such as surface mount passive components, leaded components, and even pins.

Because of the significant difference between SBE and barrel plating, electroplaters now have at their disposal an effective tool for electroplating miniaturized components that can leave a wealth of problems behind, including uneven plating, small parts fouling, coupling, and barrel maintenance costs.

Typical spouted beds consist of a cylindrical vessel containing the parts to be plated – which form the spouted bed – with a conical bottom section. A centrifugal pump is used to introduce electrolyte into the spouted bed vessel at the bottom of the conical section as a variable speed jet. The jet circulates parts throughout the plating chamber during cleaning, activation, plating, and rinsing operations.

This electrolyte jet penetrates the bed of parts contained in the spouted bed vessel, entraining them and forming a “spout” of upward moving parts and electrolyte.

The parts contact a deflector plate, disengage from the electrolyte flow in a region above the particle bed, and fall on top of the downward-moving bed of parts—the spouted bed – located at the base of the vessel. The “pumping action” provided by the spout circulates the parts through the vessel in a torroidal fashion; upwards in the spout and downwards in the moving bed of parts.

All plating of the parts being processed occurs in the conical section of the vessel where they gather to form the packed bed. In essence, plating takes place in a conical-shaped chamber with ultrasonic action and continuous solution pumped into and out of the chamber to facilitate part movement and introduce fresh plating electrolyte during the plating process.

The parts deflector is a conical point or flat disk located above the spout. The deflector prevents the parts in the spout from exiting the chamber and directs the part trajectories toward the sidewall of the vessel. It also prevents the jet of entrained parts from colliding with any overhead components in the chamber.

Removal of parts from the plating chamber requires taking out the internal deflector and disconnecting the inlet tube from centrifugal pump that forms the spout. As the parts tumble downward, they can simply be caught in a collection vessel. It is not uncommon for this process to handle loads up to 50 to 500 ml. Anything below 50 ml would require increased media.

Advantages

Higher quality and improved part-to-part thickness distribution. Platers know that it is critical for electroplating solutions surrounding parts to be as fresh as possible. The SBE plating process produces quality plating conditions because the solution is continually and rapidly introduced into the vessel. This high-quality plating environment reduces defects and improves corrosion resistance and conductivity because it is not subject to the solution introduction restrictions found in barrel coating. The result is uniform plating coverage in high and low current density areas of the part in addition to counter bores.

All plating of the parts being processed occurs in the conical section of the vessel where they gather to form the packed bed. In essence, plating takes place in a conical-shaped chamber with ultrasonic action and continuous solution pumped into and out of the chamber to facilitate part movement and introduce fresh plating electrolyte during the plating process.

Cost-effective. The high-velocity jet of electrolytic solution actually facilitates both the movement of the parts to be plated as well as improving plated metal distribution. When working with metal platings like gold, nickel, electroless nickel, palladium, and copper, the savings can be significant.

Improved Rinsing. Electrolytic solutions are circulated throughout the plating vessel at high speeds. These same high speeds are used for rinse water, which in turn dramatically reduces the contamination of parts.

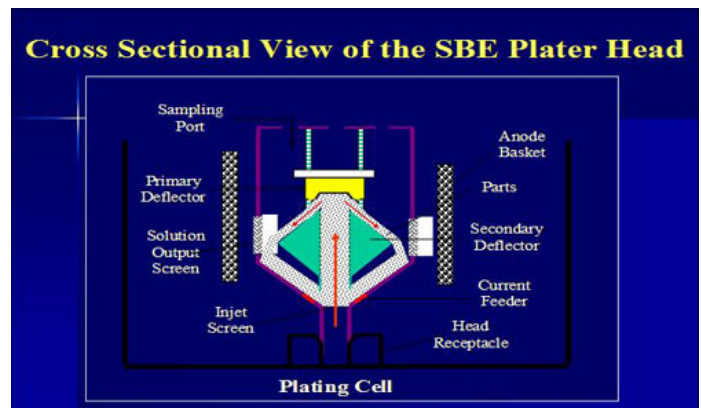
No moving parts. Because SBE platers have no moving parts like gears or doors, there is virtually no opportunity to snag or entrap miniscule components. Not only are unplated parts eliminated, contamination from previous batches is dramatically reduced. And although the SBE platers have no moving parts, the complete units can easily be moved to customize plating lines.

No nesting, interlocking, or coupling. The SBE plating chamber rapidly moves parts throughout the electrolyte and gives them little opportunity to become entangled. Furthermore, the deflector plate prevents parts from clumping, but causes no damage because the components have little mass and contact takes place under solution.

Reduced maintenance. Plating nodules do not form in the SBE electroplating chamber because parts contacting the solution output screens are no longer part of the packed cathodic bed, so they cannot transfer metallic nodules to the screens. This means that, unlike barrel plating, tedious, potentially damaging, time-consuming, and expensive nodule removal is eliminated. In effect, there is virtually no maintenance involved when operating SBE platers, other than periodically stripping the current feeder.

Less Media. SBE plating requires less media than barrel plating. Lowered media requirements reduces costs and improves the plating process because the chamber contains more parts and less media.

Improved Sampling. Because no interruption of the plating process is required when sampling deposit thicknesses, cycle times and plated metal costs are lowered.



Description	<ul style="list-style-type: none"> · Was specifically designed for parts with dimensions smaller than 1 cm in any single dimension · Variable speed pump that circulates parts throughout the plating chamber during cleaning, activation, plating, and rinsing operations · Suitable for plating parts that are difficult to plate in traditional equipment, including surface mount passive components, flat parts of various sizes, leaded components, and pins · It is perfect for parts that nest, cup, or lay flat against each other. It is also excellent on pins with deep counter bores for ID coverage · Consists of a bed of metal particles that are kept moving by recirculating the particles through one or more "spouts"
Background	<ul style="list-style-type: none"> · Miniaturization in the electronics and semi-conductor industries has led to the emergence of discrete micro-sized components such as headers, connector clips, chip capacitors, resistors, varistors, and inductors · Components often require electroplating as a finishing step to impart specific corrosion, wear resistance, conductivity, and solderability characteristics · Size of these components has been reduced so significantly in recent years that conventional electroplating equipment technologies are not fully suitable for this purpose
Process	<p>Occurs in a chamber with ultrasonic action and continuous solution pumped into and out of the chamber to facilitate part movement and fresh plating electrolyte during the plating process</p>
Metal Plating Coatings Example	<ul style="list-style-type: none"> · Gold · Nickel · Electroless Nickel · Palladium · Copper
Advantages	<ul style="list-style-type: none"> · Higher Deposit Quality (coated in Fresh Solution) · Evenly Plated Metal Distribution- very uniform plating coverage in high and low current density areas · No Moving Parts · Improved Part-to-Part Thickness Distribution · Lower Operation and Materials Costs · Reduced Coupling · Increased Production Speeds · Reduced Maintenance