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ENGINEERING INSIGHT

Surface Treatment Process Delivers Multiple Solutions

Microabrasive blasting lends itself to automated systems

Implants, minimally invasive devices, diagnostic systems, and other products that interact with the body typically require advanced surface treatment. Standard electrochemical etching and micromechanical machining methods may be too costly or insufficiently targeted for all applications. With this in mind, contract manufacturer Morton Bowen Inc. (Broomfield, CO, USA) decided to test microabrasive blasting as an alternative technology because of its flexibility and cost-effectiveness.

A microabrasive blasting system can be used to clean and prepare stent surfaces for electropolishing.

Rough Guide to Microabrasive Blasting

Microabrasive blasting can be described as a highly refined and miniaturized version of sandblasting. It involves mixing small amounts of a very fine abrasive powder with a pressurized stream of air that is metered and regulated. In manual systems, an operator holds a pen-sized hand piece that directs the abrasive-and-air mixture from a 0.018-to-0.060-in.-diam nozzle. Microblasting is performed in an enclosed workstation designed to contain the abrasive particles and provide the operator with a clear view of the workpiece.

The shape, size, and hardness of the abrasive particles, as well as the air pressure and blast duration, dictate the effect the process will have on the material surface. The pinpoint accuracy achieved with microabrasive blasting allows an operator to process very small parts without the need for masking.

Because it produces dust, microblasting is conducted in a controlled environment that evacuates particles through a vacuum system. A commercial dryer is used to maintain absolutely dry media. Based on his experience with manual systems, Morton Bowen founder and president Clive James speculated that it might be difficult to automate microblasting while maintaining the level of cleanliness dictated by medical device manufacturers. The only thing to do was to experiment with the technology.

Testing the Technology

The first step was to test the process on the types of jobs routinely performed by the company. Specifically, Morton Bowen focussed on oxide removal, surface texturing to promote adhesion, and conditioning for echogenicity.

After the heat-setting operation, nitinol requires oxide removal to prepare it for electropolishing. Microabrasive blasting systems using 17.5- to 50-µm aluminium oxide media at 40 to 90 psi were tested on several types of devices. The process was successful, allowing surfaces to be electropolished to a clean blemish- and crack-free finish.

In another set of tests, identical media were used to enhance the adhesive properties of stainless-steel devices (air pressure was matched to the specific needs of each product). “Blasting stainless-steel surfaces provided [us with] the ability to selectively treat even very small areas to enhance adhesion of a coating, overmoulding, or attachment,” James says.

Optimizing the echogenicity of an implanted device “might mean roughening the tip or section of a stainless-steel needle to make sure it will show up clearly on an ultrasound,” James explains. The only other ways to achieve this result, he adds, are to apply a coating, dissimilar-metal plating, or cladding to the instrument.

Microabrasive blasting proved to be a more effective solution than other methods in many of these cases, says James. “It’s cost-effective and simple to perform, and it can be localized to a very specific section. This is difficult to do with complex electrochemical systems, for example, because you don’t have that finite control.”

Moving toward Automation

Once the process was proven successful, the next step was to partially or fully automate microabrasive blasting to demonstrate the technology’s potential to Morton Bowen’s customers. Colin Weightman, applications engineer at Comco Inc. (Burbank, CA, USA), which produces the blasting systems, worked with James in adapting microabrasive blasting to semiautomated and automated applications.

“Custom blasting systems are extremely common today in medical manufacturing,” Weightman says. “Our typical customer will start out using a manual station. As a product advances through clinical trials, greater numbers of parts are required. In order to maintain a high level of quality, special fixturing is required. This typically involves a means of holding the nozzle and accurately rotating the part,” he explains. “The newest blasters have fewer internal parts and integrated electronics, which make in-house customization easier to do than ever before. With new industrial vacuum systems, dust is not a problem except in the most extreme cleanroom applications.”

By working with Comco, Morton Bowen was able to create production processes that meet changing customer needs. “Now, prototypes are produced using skilled operators, simple fixturing, and the accumulation of data for a controlled process,” James says. “Once past this stage, we can look at using semiautomation and finally full in-line automation of the blasting process as demand grows.”

To learn more about Morton Bowen Inc. or Comco Inc., go to RequestLink at www.devicelink.com/emdm.