Micro Mechanical Deburring and Polishing by A F Kenton

Downsizing, I suspect that everyone knows what this word means. Presently it is a trend for company and/or employee reductions. In the mechanical mass finishing industry this is the trend in part size and processing of high-tech small parts. In both applications, the work and / or situation invokes apprehension.

Normally, small parts are associated with the jewelry industry. But the demands of high tech electronic and medical industries have much more intricate and delicate parts than the jewelry industry. Besides size, there is the added demand to deburr and polish these parts while maintaining tight dimensional tolerances. Parts must fit, form and function. Also, more surface refinement is necessary as people learn more about the hazards of micro-organisms. It is not just a matter of deburring sharp edges, but of eliminating the surface variations that allow foreign matter to reside on the surface.

Small is a relative term. For clarification, small is anything less than a half-inch square or in diameter. One exception to this rule is flat parts. These creatures behave similarly to small parts, even if they exceed two or more inches and 1/16 inch in thickness.

Mass finishing has been regarded as rough and dirty technology because there are no inherent measuring devices or computers built into this type of equipment. Rather, the systems rely on the variable elements of media, compound, equipment and time cycles. Therefore, the operator's knowledge of these factors is critical to the outcome of the overall process or finished part. These variables are why most companies would rather not become involved in mass finishing. However, they are extremely efficient systems when operated correctly.

Most mass-finishing systems use water with either a plastic or ceramic preformed media having uniform size, which is formulated for deburring or polishing machined parts. The larger the size of the media and /or grain size within the media matrix, the faster the media will work to remove the burr and modify the part's surface. What prevents you from using the largest size media are the part size and configuration. Unless the media can contact all the surface features that have to be worked, size is incidental and detrimental. Any media with a grain size of 120 grit or smaller is usually too small to deburr and be effective in a reasonable time period of four or five days.

There are now three generations or mass-finishing equipment in use. They are the barrel, vibratory and centrifugal systems, listed in order of oldest to newest and slowest to fastest. Each system has advantages and disadvantages. Because time is money, the trend is toward the newer centrifugal systems with automatic unloading systems. They are expensive, but they are efficient. The barrel system still produces good looking parts, and the vibratory systems have good unloading systems.

As for negatives, some of the centrifugal disc-type finishing systems may have problems with media or parts less and 0.02 inch. The centrifugal barrel systems don't have this problem. Vibratory systems, or any system with drain plugs, also have problems with small hole openings and need to be sealed, if the parts or media are smaller than the drain holes. Normal barrel type systems are simply slow.

To deburr or polish a small part requires much longer time cycles than larger parts using media smaller than the part. You cannot us most water and chemically enhanced processes. In nearly all cases, water acts like an adhesive. Flat parts "glue" themselves together and ride up the machine's interior wall. This causes non- uniformity of finishes in a batch-type process.

To process small parts in mass finishing equipment, it is recommended that you use only dry organic media systems. Surprisingly, dry organic materials of wood, shell or cob, when combined with roughs and/ or grits, work well on small parts. The finer the media, the longer the time cycle. In order to speed up processing, these media systems are formulated like and epoxy with a Part A and B. This is the same principle used by buffing wheels. The wheel (part A) provides the energy to the rough (part B) which does the actual work.

Dry organic materials are usually mixed in a ratio of five parts of an organic or inorganic shape to one part of an organic sawdust compound blend. However, with very small parts, the use of all of part B is not uncommon. With usage, the part B breaks down and/ or needs to be replaced; therefore, it is recommended you add a handful of part B to every new batch of parts to be processed. In some cases, a liquid additive can be used to recharge this mix. Also, because of this breakdown, keep a cover on the machine. This keeps down the dust and retains heat that speeds up the polishing process.

There are occasions where dry inorganic grits can be used effectively as well as abrasive preforms down to two mm in size. Some preform spheres even go down to a 30-60 mesh and do a nice job of material removal. Aluminum oxides are popular for deburring and polishing; however, this does not seem to work as well as garnet or zirconium for deburring. Soft metal parts of aluminum, pewter or lead requires soft abrasive and polishing mixes with corn cob as the primary ingredient. Stainless steel and/or steels with Rockwell hardness or more than 50 on the B scale usually require much harder, coarser media that may contain walnut shell.

If you use a two-part dry organic mix, you can save yourself problems if you take care in your media selection. You do not want a mix in which your compound is smaller than the part and the part A pusher is larger than the part. In the latter situation, you will have to do a double screen separation operation. The most efficient media separation system is to have parts larger than the media, because there are no effective reverse parts separation problems. A reverse system would still have the problems of achieving 100 percent surface contact.

Part separation is one of the most important and time-consuming aspects of small-parts processing. Accountability and material handling can be a major headache. If parts are less and 0.06 inch, forget picking them out by hand. You need a screen separation system and that usually means a secondary material handling operation.

Some mass-finishing machines have built-in separation systems or are automated to dump into a screen system. With very small parts these screens become specialized and awkward. There is a patented separation system, the Inseparator, that can separate out parts down to 0.03 inch and in less than one min with 100 percent separation, provided the media is smaller than the part.

Because we are dealing with dry processes, it is suggested that you clean your parts after processing. Ultrasonic systems seem to work best for small particle removal. However, water-based systems may not be wet enough to clean effectively. Deionized water may be more effective than water. Be careful of chemical additives. Any product with a pH of 10.5 or higher or 4.5 or lower may etch the parts.

Small parts require different approaches, even though the results are the same.

- Nova Finishing Systems Inc., manufactures small, heavy-duty bowl finishers that stack up to most of the big equipment on the market, but cost much less. Nova series vibratory equipment also comes with the same warranties of the larger machines.

For more information on this equipment line, contact:

NOVA Finishing Systems
559 Crook Street
Hampton, TN 37658
980 429-5773 Tel,
704 665-5658 Fax
NOVA@LTSmachinery.com