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Managing Manufacturing Ramps

The job of a process engineer is to increase manufacturing efficiencies by reducing the variances of fabrication processes. Micralyne has gone through a number of manufacturing ramps with its customers that move a MEMS product from prototype to high volume production. During this phase, issues surrounding processing are often magnified and can potentially make a transfer to manufacturing longer and more costly.

Micralyne's business is to translate a customer's MEMS-based product design into a set of fabrication processes that can be used to manufacture a product at high volumes. Moving from a development or prototyping stage to high volume manufacturing involves a manufacturing ramp that can ultimately make or break a successful product launch. Micralyne has implemented a number of internal processes that have measurably improved the success of our manufacturing ramps and, in this edition of Newslyne, I would like to address two of our most important tools.

First, Micralyne has implemented a number of in-house monitoring systems that allow us to understand and address any fabrication process step variations. We have made a significant investment into these on-line tools and they record the performance of key process steps which in turn facilitate the use of such tools such as SPC (Statistical Process Control), Cpc & Cpk (Process Capability Ratios), Pareto analysis, X-bar and r-charts (Average & Range). This data gives us guidance on what issues to tackle first.

Our online systems measure important process variables such as material thickness, deposition rate and uniformity. By monitoring these systems in real-time, we can first ensure process results are on target and then identify and remove sources of process variation. To reduce variance, Cpc & Cpk data are again reviewed and if they are still unsatisfactory we repeat the process and continue this loop until we are satisfied.

Our second key tool is to ensure that members of our process engineering team are involved in new product development projects at a very early stage and long before they move into volume production.

Our past experience indicates that the earlier our process engineering team gets involved in a development project, the more efficient and cost effective a manufacturing ramp will be. In fact, our customers often wonder why we are involved so early but we explain it is clearly to their benefit. In particular, we explain that a manufacturing ramp will occur much more smoothly if we utilize our known processes ("known" meaning we have statistical data to ensure repeatability and

reliability) and the process engineering group is the repository of this detailed process knowledge.

Overall, whenever we can integrate a series of standard processes and minimize or eliminate the creation of new processes, we can ensure that we generate higher product yields right out of the gate.

In conclusion, the use of proven statistical methods, implementing collection tools customized to our fabrication processes, and ensuring heavy interaction between development engineers and process engineers will all greatly enhance product development success. This in turn will reduce the costs and timelines associated with a manufacturing ramp and product launch.

- **Bob Williamson, Process Engineering Manager, Micralyne Inc.** -