Improving the Measurement Process

In previous practices, you learned that the process of measuring the melt flow index is so poor that none of the previously collected historical data can be trusted. The biggest problems are the repeatability variation and the reproducibility variation between the instruments. The measurement process is in drastic need of improvement. In fact, you can't improve the capability of the process relative to the Melt Flow Index until you fix the measurement system. Let's say that you are an engineer, leading a team working on improving the measurement process. You observe the measurement process and interview other technicians. You learn that the samples can sit for various lengths of time before being analyzed. You also learn that the analysis steps occur in various sequences and suffer different time delays. After careful study, a standard operating procedure is agreed upon that specifies the exact sequence of operations and timeline to be used in processing the samples. You also learn that the four instruments used in the study are of different age. Two are older, and the dies are worn.

The decision is made to replace the old instruments with two new ones, and the set of four is tested and calibrated to ensure consistent readings. After taking these actions, you repeat the measurement study to see whether the changes were successful in reducing the measurement variation. The average chart shows that the measurement process can easily tell the difference in the different batches of materials. From the parallelism plots, you see that the lines for the operators and instruments are almost perfectly parallel. The Gauge R&R report shows that 99.5% of the total variation is from the product, or the differences between the batches.

To put this in perspective, you might recall that the specification limits for MFI are 192 to 198. This is a tolerance interval of 6 units. The standard deviation for the measurement system is 0.105 units. This means that the range of variation we can expect from our measurement system is plus or minus 3 times 0.105, or 0.63 units. This is approximately 10.5% the width of the tolerance interval. The measurement system for MFI is now quite capable of telling the difference between good and bad batches relative to the specification limits.

Statistical Thinking for Industrial Problem Solving

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