



## CASE STUDY | Reducing Epoxy Spot Defects

### A laminates company reduces number of epoxy spots on final product

#### The Problem

A laminates company was experiencing a large increase in the number of epoxy spots left on the finished product after the manufacturing process. This problem had started several months earlier when the company changed its customer requirements. The epoxy spot defects were increasing scrap and manufacturing overhead costs, and reducing on-time delivery rates due to rework, remake and inspection activities.

The company assembled a problem-solving team to investigate the situation and launch a project with the goal of reducing the epoxy spot defect rate from 1.5 percent to 0.35 percent. The team estimated this shift would cut material costs by approximately \$100,000 annually.

#### The Solution

The project team started investigating where the spots were coming from by looking at all the possible reasons for the increase in spots. They quickly ruled out variations in the inspection process as a major cause of the problem since inspectors merely counted and documented the number of epoxy spots. So, instead of focusing on inspector variation with a Gage R&R study, the team used process maps, affinity diagrams and fault tree analysis to determine the greatest sources of the epoxy spots.

The team identified two main sources of increased epoxy spots: operator handling of materials and “random factors.” The latter included many variables – trays, conveyors, even the air itself. The team felt that pursuing these “random factors” would require a long, comprehensive investigation that may not lead to the level of change it desired. Therefore, the team chose instead to dig deeper into the operator handling procedures to locate potential areas for improvement.

The team’s research suggested that handling prepreg (a raw material used in the laminate process) caused some operators to collect epoxy dust, which was then sometimes accidentally transferred to the finished product. Team members tested this theory by running a two-

proportion hypothesis test. The results indicated that operators with clean hands produced 40 to 80 percent better yields than those who touched the prepreg material before handling the laminate.

Therefore, the team looked at ways of standardizing the hand-washing process for all operators who came in contact with the prepreg material. Their research showed that in the current state, the operators who handled prepreg were in the habit of cleaning their hands after every instance. However, operators at one location cleaned their hands with alcohol-soaked rags while those at another plant used only tac cloth.

The team ran hypothesis tests to compare the two methods. Tests showed that the alcohol-soaked rag cleaning process yielded 40-50 percent better results than the tac cloth method. In addition, the tests found that one pair of operators yielded consistently better results than all the others, regardless of the method of cleaning they used.

Digging a little deeper, the research team showed that these two “cleanest” operators always washed their hands thoroughly, wiping two or three times after touching the prepreg.

To see if it was the operators or the process that was causing the improvement, the project team conducted a Design of Experiments with a different pair of operators who typically cleaned their hands with only a single wipe (like most operators were doing). Test results showed the triple wipe yielded 40-80 percent fewer epoxy spots than the single wipe.

#### The Results

The team proposed that operators standardize on a new hand cleaning method using tac cloth and that they wipe their hands more thoroughly including behind the fingers and inside the thumbs. The team also provided detailed instructions on the new procedures and established methods to track the operators’

adherence to this new procedure. Since the implementation of the new cleaning method, the company has experienced a 66 percent reduction in epoxy spot defects resulting in annual savings of more than \$320,000 in material and overhead.

#### Summary

##### Industry

Manufacturing

##### Business Problem

High rate of defects due to epoxy spots

##### Methodology

Six Sigma - DMAIC

##### Solution

Reduce defects by making a change in operator handling procedure

##### Benefits/Results

\$320,000 in annual savings

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