Quality of Material Poses Risk

Problems with Outsourced Products Begin with Materials

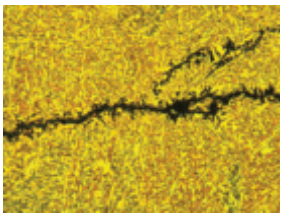
The headline shocked parents throughout the U.S.; "Child Dies From Lead Content in Costume Jewelry." The tragic incident put a spotlight on the use of potentially toxic materials in products made for the U.S. market by foreign manufacturers. The near panic that followed left the impression on many that the use of such materials was deliberate; some felt that the overseas supplier was somehow trying to get away with something.

Today's headlines show that we haven't solved the problem; we hear of melanin in pet food, lead paint on toys, and ethylene glycol used to flavor toothpaste. More now than ever before products made outside the U.S. are causing consumers concerns over health and safety.

Placing blame, however, is not as important to professional engineers as solving the problem. At Crane Engineering, the materials team has discovered that both the sponsoring firm and the outsourced supplier can be at fault.

We find that most outsourced materials problems fall into three main categories.

FIRST, FAILING TO PROVIDE DETAILED SPECIFICATIONS.
A supplier of plumbing fixtures experienced a high rate of failure in products made under contract in Asia. At first shoddy assembly was suspected but the real cause turned out to be the failure of brass components. The reason: brass in China can have a zinc content that is significantly different from brass that would be used in the U.S. The specification was not sufficiently detailed for the Chinese maker to understand the need for a particular grade of material.

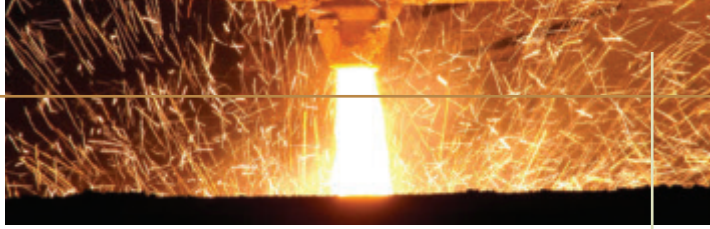


This photomicrograph clearly illustrates the effect of stress corrosion cracking in brass. This product failed by the combined effect of excess of zinc in the brass material and the presence of ordinary tap water. Cracking occurs through the high zinc regions in the alloy which are effectively dissolved into the surrounding water over time, leading to a potentially catastrophic failure.

Economics can contribute to problems when specifications are insufficiently detailed. U.S. based companies often delegate sourcing to purchasing departments which are staffed by professional buyers, not engineers. The message the Asian supplier receives gets translated as, "You must give us the absolute lowest price or we will find someone who will." If the specification leaves room for the substitution of materials which are apparently, but not actually, identical the resulting problems can be serious.

In our experience, professional purchasing people are more than willing to insist on adherence to specifications, which requires that all the information be there in the first place.

SECOND, MANUFACTURING PROCESSES THEMSELVES CAUSING DOWNSTREAM DEFECTS IN PRODUCTS.
A client submitted two castings that appeared to be identical at incoming inspection. One, however, quickly discolored after exposure to moisture, affecting the quality and appearance of the product. Crane's forensic testing found traces of magnesium, calcium, and other deposits that had



transferred to the surface from residual contamination within the manufacturing process. Failure to clean and maintain process equipment allowed the migration and transfer of material between process runs.

"Bad" sample shows significant deterioration in surface quality due to poor process control and contamination within the process.

"Good" sample shows a highly uniform surface texture indicative of a well-protected surface.

THIRD, POST-MANUFACTURING ENVIRONMENTS THAT IMPACT PRODUCT QUALITY.
An international supplier of large scale filtration systems experienced corrosion on silencer baffles at sites where new products were installed. The products were sourced from a factory outside the U.S.

Initially the internal technical team suspected a variation in galvanized coatings. Testing revealed, however, that the coatings were of uniform thickness and that the material composition met ASTM standards.

On-site examination of parts reveals severe corrosion on parts that were considered new and had not been used. Testing showed that coatings met ASTM standards and that the coating process was uniform.

Temporarily at a loss to understand what caused the corrosion, the forensic engineering team turned its attention on post-manufacturing processes. What they found was dramatic – crating panels revealed extensive moisture damage which, when coupled with incorrect packaging methods, exposed the product to unacceptably high levels of humidity and temperature. The combination of packaging errors led to the destruction of otherwise good products.

Writing packaging specifications for outsource suppliers almost always includes force-damage requirements. Drop test survival, load requirements, maximum packing-stacking limits, and external temperature and humidity conditions are typical categories. We strongly recommend the inclusion of specifications that deal with how those factors are allowed to affect the environment inside the primary container.

The forensic engineering team's investigation of the packaging proved high levels of moisture infiltration. The resulting exposure of the product to the combined effects of high humidity and temperature ruined otherwise acceptable products.

Cases certainly exist in which contract manufacturers knowingly use substandard material to cut costs, decrease cycle time, or to avoid costly process modifications. Our experience shows that this occurs only in a small number of cases. Far more often the cause of materials issues in products is due to a failure of one party to clearly communicate requirements to the other. Increasing the time spent to ensure the intended quality can save many times the effort it takes to clean up after a catastrophic product failure.

Dr. Jeff Pfaendtner, P.E. is a material scientist with 17 years of experience in the development of materials and processes, materials characterization and failure analysis. He provides litigation support and expert witness in addition to leading Crane Engineering's technical services team. For more on Dr. Pfaendtner or the Crane Engineering technical team, go to www.craneengineering.com.