

542c Environmentally-Friendly Replacement for Mercurous Nitrate Test of Copper Alloys

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Brass cartridge cases are tested for tensile residual stresses by mercurous nitrate immersion in accordance with ASTM B154. The test has been used for many years as an accelerated, lot acceptance test to detect tensile residual stresses that, when combined with a corrosive media, can cause stress corrosion cracking during long-term storage. This is often called “season cracking” of brass. However, regulatory standards, disposal cost and employee exposure issues justify the need to replace the mercurous nitrate test in an expedient manner. The 30-minute test involves immersing the test specimens in mercurous nitrate solution. At the end of the test, the mercury-coated samples are inspected for cracks under low-power optical microscope. The presence of cracks would indicate that the part contains enough tensile residual stress to make it susceptible to stress corrosion cracking. The drawback with this test is related to the disposal of the mercury coated test specimens and the mercury contaminated solutions. With the inception of Environmental Protection Agency (EPA) new clean air standards in September 2003, in particular Maximum Achievable Control Technology (MACT) standards, the disposal of mercury has been affected. The disposal cost has become increasingly prohibitive. When the final MACT standards take effect in 2005, the remaining disposal sites for mercury may become noncompliant.

Despite waste minimization efforts, mercury-contaminated waste is still generated with the current test method. Several possible replacements for mercurous nitrate have been identified. The objectives of the mercurous nitrate replacement tests are:

- Provides timely results.
- To be less hazardous to personnel and the environment.
- To be implemented in current production environments, preferably using existing facilities.

An accelerated ammonia vapor test has been successfully demonstrated and is being scaled up to accommodate facility test quantities. An accelerated ammoniacal copper sulfate has also been successfully demonstrated. The proposed replacement test(s) will be tested alongside the current mercurous nitrate test method to ensure that results correlate strongly. The proposed replacement tests will be less hazardous to the environment and personnel, will reduce the cost of lot acceptance testing, and will comply with increasingly stringent environmental regulatory requirements.