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For the attention of Mr P Johns

Report Number: 963854

Resistance to Firestain Evaluation of Silver Alloys

Introduction

The 5 silver alloys described below were subject to a set procedure to simulate firestain that might occur during torch annealing or soldering of these alloys.

Samples Tested

Standard Sterling Silver - Produced by Thessco Ltd (UK)

"Argentium Sterling Silver" (930 silver alloy) - Produced by Stern-Leach (USA)

"Lustre Silver" - Produced by Carrs of Sheffield Ltd (UK)

"Low tarnish low fire silver" – Produced by Cookson Precious Metals (UK)

"Plata Brillante" – Produced by Sempsa (Cookson Group, Spain)

Procedure for Testing the Firestain Resistance of Silver Alloys

The aim of this procedure is to determine the degree of firestain penetration of silver alloys when heated in a furnace at a controlled temperature with an oxidising atmosphere.

Subsequent cross-sections of samples will determine the measured depth of firestain.

Standard Sterling Silver is used as a control sample.

Procedure:

1. The 5 samples of silver alloys are supplied as bent strips, approximately 40mm x 10mm - the bend enables the strips to be stood on one edge while in the furnace.

2. Degrease test samples using either a hydrocarbon solvent or isopropyl alcohol wash. (To remove grease from handling and cutting)

3. Place in a preheated furnace at 580°C, for a time of 1 hour, in an oxidising atmosphere. (Allow a small air gap on the furnace door for oxidation of the samples.)

4. Remove samples from furnace and air-cool. Pickle in a hot (70°C) 10% sulphuric acid solution for 4 minutes, to remove surface oxides.

5. Wash test samples with cold running water and dry with isopropyl alcohol and a hot air blower.

6. Mount test sample in a Bakelite type resin, the same orientation as positioned in the furnace.

7 Polish samples to a high diamond finish, then examine under an optical microscope to determine the depth of any oxide layer created by the procedure. Measure the depth of penetration of any oxide layer into the bulk of the samples.

8. Photograph the results.

Testing

After completing the above procedure the samples were mounted and metallographically prepared to show the depth of oxide penetration, which was measured using a graticule eyepiece with an optical microscope illuminated by polarised light.

The minimum and maximum results of oxide penetration are given in Table 1 and as a bar chart Figure 1.

Figures 2a, b, c, d & e are photomicrographs showing the depth of oxide penetration, however, digitising the images loses some resolution.

Sample	Depth of Oxide Penetration (microns)
Standard Sterling	22 - 28
Argentium Silver	None
Lustre Silver	7 - 20
LTLF Silver	26 - 35
Plata Brillante	26 - 31

Table 1

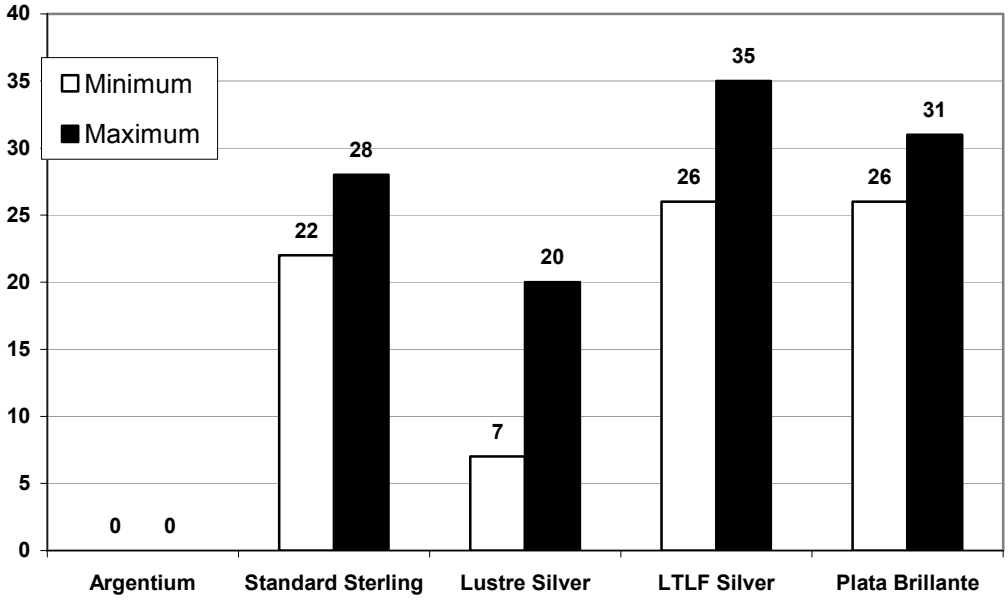

Figure 1

Conclusion

The procedure to simulate firestain has resulted in oxidation to all the silver alloys to varying extents except for the Argentium Sterling alloy.

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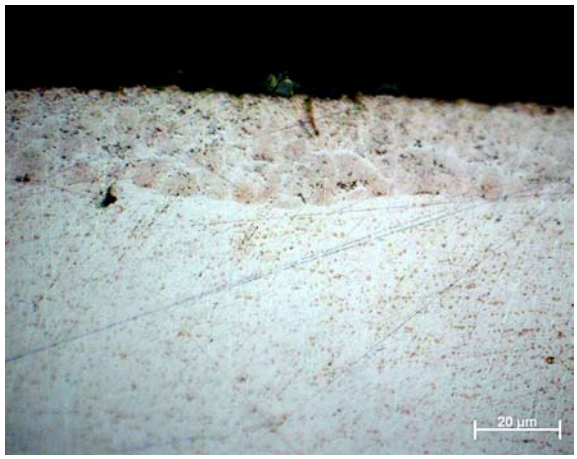

Figure 2a
Standard Sterling

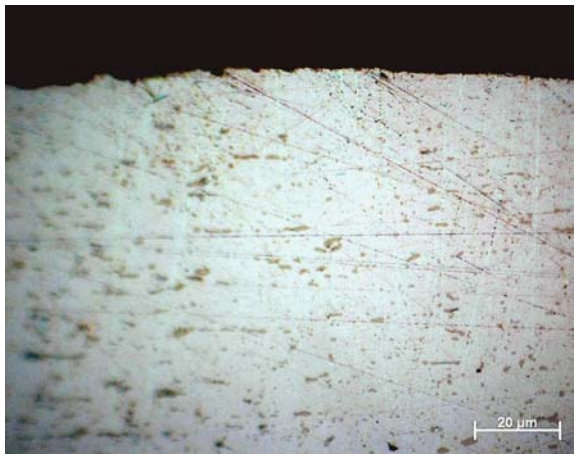

Figure 2b
Argentium Silver

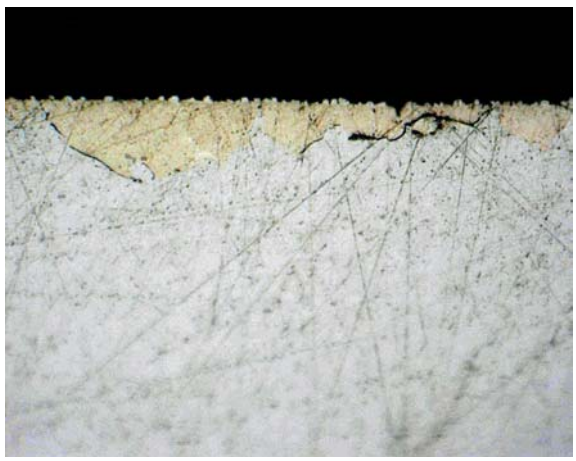

Figure 2c
Lustre Silver

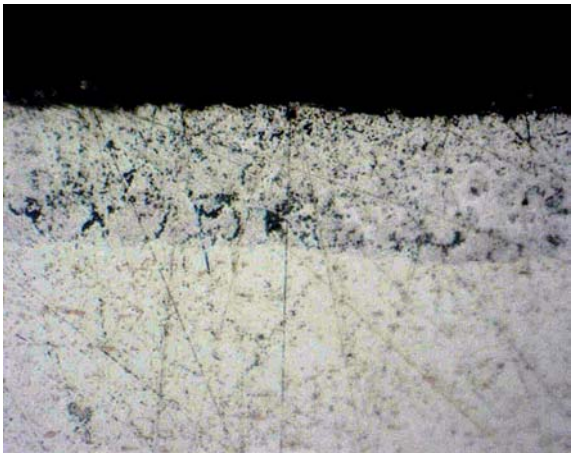

Figure 2d
Low Tarnish Low Fire Silver

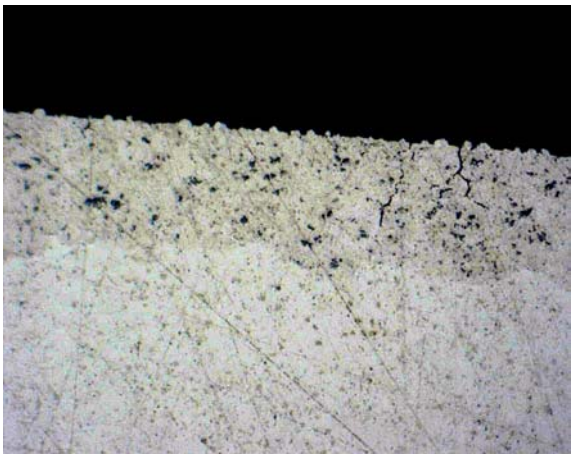

Figure 2e
Plata Brillante