

APPLICATION NOTE

Application of FISCHER products

AN024en

Analysis of Tarnish-Resistant Silver Alloys

Sterling Silver is often used for making jewellery and decorative items. However, one common problem with silver is surface oxidation, or "tarnishing". To prevent or at least reduce this effect, various alloy elements are added to the silver.

Silver is used in the production of numerous decorative items ranging from jewellery to accessories to musical instruments and fine cutlery; its bright colour makes this metal particularly attractive for such applications. The most popular alloys consist of silver and copper with typical millesimal fineness of 825, 925 (Sterling), or even 935 parts silver per thousand by mass. Cu is added to improve the strength and workability of the material.

Though silver is a precious metal, it has a strong tendency to oxidise on the surface, discolouring its bright, glossy face with a dark, dull stain. This effect, called tarnishing, also occurs in copper-alloyed silver.



Fig 1: Tarnished silver, the tarnish may appear either uniform or spotty.

Therefore, the focus of much R&D has been to improve silver's tarnish resistance through the addition of small amounts of a variety of elements, including precious metals such as Palladium and semimetals like Germanium, among others. While this vast range of possible alloys makes analysing the silver challenging, X-ray fluorescence instruments allow for quick, accurate, non-destructive analysis. Fig. 2 shows sections of spectra of various such alloys.

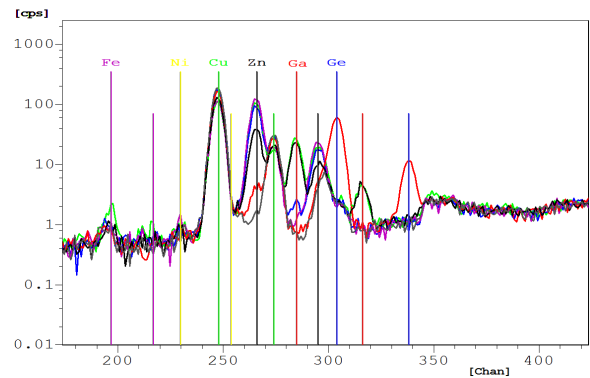


Fig 2: Spectra of various tarnish-resistant silver alloys. The signals of the more exotic elements Ge (blue lines) and Ga (red) are particularly noticeable.

For such special alloys reference materials for the calibration of XRF instruments are not always available. Therefore it is particularly important to be able to perform uncalibrated (standard-free) measurements that lead to high-quality, reliable results.

Ag	Cu	Ga	Ge	Pd	Sn	In
932	65.8	0.1	0.2	n.d.	1.3	0.3
913	59.5	0.4	0.2	n.d.	3.3	n.d.
898	37.3	6.0	0.2	31.5	n.d.	n.d.
928	56.7	0.1	12.1	n.d.	2.1	0.1
926	44.9	5.6	0.2	n.d.	6.6	5.4
922	39.5	0.1	0.1	n.d.	0.1	5.0

Table 1: Several chemical compositions of tarnish-resistant silver alloys (not listed are concentrations of Zn, Fe, Ni; in per mil).

FISCHERSCOPE® X-RAY XAN® 250 instruments are optimally suited for visualising even the subtlest differences in silver alloys. They allow precise purity measurements as well as the exact determination of tiny amounts of tarnish-resistant materials and other alloy components. For more information please contact your local FISCHER representative.

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