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XPS STUDIES OF BINARY Cu-Sn ALLOYS AGED IN CLIMATIC CHAMBER

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During the last few decades great interest has arisen concerning conservation problems of metal artefacts exposed in an open environment due to the formation of alteration products. Alteration patinas have greatly increased as a result of the increase in pollutants produced by human activity. In recent years, non-destructive surface analytical probes, such as PIXE, LIPS, and XPS have been applied to this problem. X-ray Photoemission Spectroscopy (XPS) is not always suitable for natural patinas which are often quite thick, but it can be applied to studies of patina onset obtained by ageing materials in a climatic chamber. The characteristics of this technique, in fact, make it especially suitable for studies of the initial alteration mechanisms for a large range of materials. During the initial alteration step, the corrosion products formed are usually extremely thin so that XPS may be used to detect the presence and determine the chemistry of alteration products, produced at this stage.

XPS has previously been used to detect initial corrosion products formed on metals and alloy surfaces (in particular copper, bronzes and brasses) exposed to pollutant gases such as SO_2, NO_x and Cl_2. These include phases such as Cu_2O, CuO, CuCl, which correspond to the minerals cuprite, tenorite, nantokite. Here, a new XPS imaging instrument has been used to detect the formation of copper carbonates, sulphates and chlorides and tin sulphides on the surfaces of binary Cu-Sn alloys aged in a climatic chamber with SO_2 as a pollutant. Parallel XPS imaging has been used to acquire a wide energy spectrum at each pixel, which coupled with PCA analysis has been employed to obtain enhanced image contrast between elemental and chemical speciation at the alloy surface.