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Non-invasive FTIR characterisation of varnishes of ancient brass scientific instruments belonging to the "Physic Cabinet" of the "Fondazione Scienza e Tecnica" in Florence

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A series of over 40 scientific instruments belonging to the collection of "Fondazione Scienza e Tecnica" in Florence were submitted to scientific investigation by means of a portable Fourier transform infrared spectroscopy (FTIR) instrument (Bruker Alpha) in order to characterise the varnishes applied on the brass parts and surfaces. Brass is one of the most used materials for scientific instruments, with wood and glass, and the issue of its protection was taken into account since the earliest manufacturers. The literature reports various recipes of so-called "lacquers", most of them based on alcohol and mixtures of several natural resins, gums and dyes.

In a previous work [1] the authors did search these recipes and replicate a series of brass historical lacquers; they were applied in thin film on a polished brass plate, then aged and examined by means of reflection FTIR. The quality of the spectra collected was very high because the phenomena of "transflection" in which the flat metal surface reflects the whole incident radiation doubling the beam path and straightening the peaks.

In this work the authors have chosen a large selection of scientific instruments used for research and didactics in physics and manufactured in Europe in the nineteenth century, with the aim to characterise the brass varnishes, to detect the ingredients formulation and to organize a comparison among the various instruments, according to the geographical provenience, the time and the workshop of production. The use of a portable FTIR equipment, working in total reflection mode, enabled us to analyse in a non-invasive way a large number of brass containing scientific instruments and, in some cases, the possibility to disassemble some parts or details offered a great help to the investigation of the surface. The results are organised in "families of lacquers" according to the spectra similitudes, and each family related to the geographical area of provenance. The importance of this work is also in the well-known geographical production of the scientific instruments belonging to the FST collection: this could be of great importance as a reference base of the instrument provenance, in case of unknown manufacture.

The final aim of this work is to start the building up of a freely available database of brass scientific instruments varnishes, useful for conservation scientists and collection curators, in order to catalogue and compare the lacquers composition. It represents also a guide for restorers and conservators to make informed decisions on the processes to adopt to preserve and restore the original varnishes.

[1] Anna Giatti, Giancarlo Lanterna, The non-invasive FTIR characterisation of brass varnishes of historical scientific instruments. *Proceedings of the conference Technart 2015, Catania 27-30 april 2015, O - 88*