Regular Article

Synchrotron radiation micro-computed tomography for the investigation of finishing treatments in historical bowed string instruments: Issues and perspectives*,**

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Abstract. Coating systems in historical bowed string instruments are often multi-layered structures, where several inorganic and organic materials are variously combined. The methods to characterise such complex systems normally require samples to be detached from the artwork, whereas Synchrotron Radiation micro-Computed Tomography (SR-micro-CT) may reveal —through a non-invasive approach— procedures and materials employed by the ancient violin makers. Since the application of SR-micro-CT for the investigation of the finishing layers in historical bowed string instruments is still unexplored, the experimental settings were optimized for the detection of the main features expected in the finishing layers of a historical instrument. In this work, two sets of mock-ups mimicking the finishing layers of historical instruments and a large fragment removed from a damaged cello by Andrea Guarneri were scanned. By considering SR-micro-CT data, and data obtained by previous micro-invasive analyses, the merits of reconstructed volumes and virtual slicing in investigating the layered structures have been highlighted and discussed. The developed procedures enabled the detection of the main morphological features of the overlapping layers, producing a valuable, non-invasive insight into the structure of the coating systems.

1 Introduction

The smooth and shiny varnish of a historical violin is the most perceivable portion of a complex multi-layered coating system, which may contain a variety of inorganic and organic materials [1]. All these materials are involved in the finishing treatments of the musical instrument, enhancing the aesthetic features of the wood, protecting the object from wear and influencing the tonal features of the sound [2].

Nowadays, scientific investigation represents a powerful tool to rediscover the lost materials and methods adopted in the finishing treatments employed by early masters of violin making, which were traditionally passed down orally to apprentices, and forgotten when the workshop's activity ceased. Scientists have invested effort in setting up new analytical schemes and innovative techniques and procedures for probing the instruments, in order to obtain relevant information for properly identifying the context of production [3–5]. The main focus has been the characterization of the Cremonese varnish and of the other materials involved in the finishing treatments [6]. However, the in-depth coating

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