Applications of Laser and Ultrasonic Techniques in the Cleaning of Metal Threads, Applied on a Selected Object

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Abstract

This present work deals with testing and application of innovated non-destructive cleaning techniques for the cleaning of a delicate category of historical composite artefacts. As gilded metal threads which involved for embroidery purpose appeared to be of significant value and importance; and highly correlated to the richly-noble classes through the history, due to the nobility and beauty of gold. As this category of embroidery has long been a mark of wealth and status in many cultures including ancient Persia, China, India etc.

An Indian Mogul fabric dates back to the 17th -18th century A.D. was selected as a case study in this research. This fabric showed different aspects of degradation and corrosion.

Recent advanced examination and analytical techniques were undertaken to identify organic and inorganic composition of the fabric. Light Microscopes (LM), Polarizing Microscopes (PM) and Scanning Electron Microscopes (SEM) accompanied by micro-analysis using (EDX), Fourier-Transform Infra- Red Spectroscopy (FTIR) and Atomic Absorption Spectroscopy (AAS).

Unfortunately, most conventional cleaning techniques do not assure the efficient cleaning of metal corrosion being detected, or keeping the integrity of other organic parts. Accordingly, most of these methods proved to be ineffectual in most cases; and make it worth not to clean metal threads at all an approving concern. Searching for other non-destructive alternatives to clean such tarnished metal threads was and still a big challenge for many researchers and a main concern for metal and textile conservators.

Therefore both laser and ultrasonic probe were the proposed techniques in this study to be tested. Dry application for both was the only preferred procedure. This target cannot be practically achieved without performing simulation study" experimental" on test samples identical to the real metal threads to evaluate cleaning efficiency. Loss metal thread fragments which were found spread around in the storage drawer were involved to be used as test samples.

Based upon simulation study results, the technique which approved to be more appropriate was then applied for the cleaning of the case study. Results obtained showed the suitability of both techniques to be involved. Although, some differences have been noticed. Ultrasonic dental scaler/probe was successfully employed; within definite parameters such as potential and time. On the other hand, the other pilot tests showed the possibility of using Q-switched Nd: YAG laser at 2nd harmonic 532nm to be successfully applied for partial cleaning of metal tarnishing; without causing neither visual nor microscopic alterations of the core fibre. The application of the approved cleaning techniques came at the end to be applied on the studied object "embroidered fabric" to clean most of tarnishing layers on metal threads which resulted in distortion and dullness. Cleaning helped to uncover the aesthetic appearance of the studied object. Then, the preservative maintenance came lastly in the form of consolidation and temporary storage.

Keywords:

Metal embroidery; Metal threads; C.D.R(cast, drawn, and rolled); Galvanic corrosion; Pitting corrosion; Dry cleaning; Ultrasonic descaer; Ultrasonic probe/descaler; Cleaning; Nd:YAG laser; Q-Switching.