Laser Techniques in Conservation in Europe

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ABSTRACT

The state of the art of laser techniques employed in conservation of cultural heritage is continuously growing in Europe. Many research projects organised at the European level have contributed to this achievement, being complementary to the development carried out at national level. The COST Action G7 is playing its unique role since the year 2000 in promoting the experimentation, comparing the experiences and disseminating best practices. This role has been particularly effective for monitoring of the results of many short-term research projects completed along the G7 Action lifetime. After that several laser cleaning techniques have been followed and evaluated it appears now clear an evolution of the systems, a specialization of the cleaning task, the achievement of side-effect free procedures. The validation of these advanced cleaning techniques has been extensive and diffused in many European countries, especially for stone and metals. Laser-based diagnostics have also specialised their tasks toward material analysis, defects detection and multidimensional documentation. Laser and optical methods successfully monitor deterioration effects. In many European countries interdisciplinary networks are managing the experimentation of these techniques giving them a sound scientific approach, but also a technology transfer to end-users. So doing the appreciation for these techniques is growing in all the conservation institutions involved at national level, disseminating a positive evaluation about the benefits provided by laser techniques in conservation. Several laser systems became products for the activity of professional restorers and their increasing sales demonstrate a growing utilisation throughout all Europe.

Keywords: Laser techniques, cultural heritage, conservation, optoelectronics.

1. INTRODUCTION

The remnants of past civilizations are an important part of the historical and cultural identity of the population of each country. This is certainly true for countries where their history has left worldwide renowned cultural heritage, as in Mesopotamia, Middle east, Mediterranean Africa, Egypt, China, Europe, India, Centre America, hosting very ancient monuments dated thousands years ago. Europe cities hide stratified layers of cultural periods, as Pre-historic Ages, Classic Age, Middle age, Renaissance, Baroque in many of the historical buildings and architectures. All Latin America brings the history of Pre-Colombian civilizations and of colonial centuries in the architectural style of their historical buildings. Finally arriving to the present situation of conservation of monuments, historical buildings and museum collections, which are spread throughout the entire world with risks of natural origin, (earthquakes, floods, fires, wind, sand) and other depending on the human factor (intentional damage, war destructions, anthropogenic air pollution). The uniqueness of each piece of this treasury justifies the need of the most developed means in order to preserve the material itself against the many sources of deterioration. Because of this, the conservation community has always explored the potential of newly developed science & technology for solving the problems they are everyday facing. Since the opening of a modern meaning of restoration, chemistry has been most involved, providing reactants, poultices for consolidation, cleaning and protection. Physics as discipline has also given very important contributions as microscopy, optical and X-ray investigations.

Laser and opto-electronic techniques came in about thirty years ago, giving immediately very promising diagnostic and restoration procedures. The evolution and spread of laser techniques took necessarily many years, because of many factors: first of all the lack of scientific background in the conservation institutions, and secondly the need for more developed laser instrumentation. Nevertheless restoration interventions employing Nd:YAG lasers took place during the years 80’s in Italy, and during the early 90’s in France and in the United Kingdom. In the 90’s also in Greece and in Germany investigations using Excimer lasers began.

In Europe the 5th Frame Research Program has promoted many projects regarding the application of lasers for cultural heritage preservation. More specifically an Action of Scientific and Technological Cooperation, the COST Action G7 “Artworks Conservation by Laser”, is monitoring since the year 2000 how these techniques are developing through the