

Abstract

The habilitation thesis is structured in two main parts and briefly and documented presents a) major original scientific results obtained by the author in the scientific research and teaching activity, after obtaining the title of doctor in physics in the concerned doctoral field (physics), indicating the scientific, academic and professional career development respectively, as well as the main fields of research and development in the global context of actual significant scientific research; and b) the ability of the author to coordinate individual research teams, organize and manage teaching activity, explaining and facilitating learning and scientific research. A comprehensive Introduction highlights in brief the technological development in the Raman spectroscopy systems and accessories, then describes the complex process from fundamental research to the applied research towards innovation and finally illustrates the growing tendency of the Raman spectroscopy market, to support the chosen topic of the thesis. Part A described the scientific achievements in applied Raman spectroscopy field. The main results are focused on investigation of pharmaceutical interest molecules, geology and mineralogy issues solved by Raman spectroscopy, several investigations oriented toward the clinical diagnostic and therapy, particularly in personalized nanomedicine and theranostics, by employing noble metal nanoparticles and surface-enhanced Raman effect for tissue screening, applied Raman spectroscopy techniques and tools for food control and finally, analysis of works of art for conservation and restoration purpose. The central role of Raman spectroscopy in these apparent different fields is highlighted and prospected for the translation to market-oriented applications. It is amazing to detect by means of Raman techniques certain molecule in cells or tissue or food products or environmental microorganisms or geological deposit, or even in works of art and thus, to get insight into the complex life processes within a unique and nondestructive manner. The career development during academic activity and the research directions in the global and actual context of scientific achievements are briefly summarized. Part B comprises the individual capacity to coordinate research teams, to organize and manage teaching activity, to explain and facilitate research and teaching. Actions for research, education, cooperation, teaching research and innovation are included. Several academic achievements which are not included in the main list of publications are finally summarized.