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ORIGINAL ARTICLE

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Increased UV absorption properties of natural hydroxyapatite-based sunscreen through laser ablation modification in liquid

Clara Piccirillo[1] | **Mónica Fernández-Arias**[2] | **Mohamed Boutinguiza**[2] | **David M. Tobaldi**[3] | **Jesus del Val**[2] | **Maria M. Pintado**[4] | **Juan Pou**[2]

[1]Institute of Nanotechnology, CNR NANOTEC, Lecce, Italy

[2]Applied Physics Department, Universidad de Vigo, ETSII, Vigo, Spain

[3]Department of Materials and Ceramic Engineering, CICECO – Aveiro Institute of Materials, University of Aveiro, Aveiro, Portugal

[4]Universidade Católica Portuguesa CBQF – Centro de Biotecnologia e Quimica Fina, Laboratório Associado, Escola Superior Biotecnologia, Porto, Portugal

Correspondence
Clara Piccirillo, Institute of Nanotechnology, CNR NANOTEC, Lecce, Italy.
Email: clara.piccirillo@nanotec.cnr.it

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Abstract

Sunfilters based on hydroxyapatite (HAp) and iron-containing compounds (Fe_2O_3 and calcium iron phosphates) are of increasing interest, as they show UV absorption without generating health endanger free radicals (usually observed when other inorganic sunscreens are used). In this paper, laser ablation of solids in liquids has been applied to improve the UV absorption properties of a HAp based Fe-containing sunscreen powder derived from cod fish bones. Two different laser wavelengths were explored (532 and 1064 nm, green and infrared, respectively); an improved experimental device was used, to allow a fine control of the volume of the irradiated particles. Results show an increased UV absorbance for the laser-treated powders in comparison with the untreated ones; this can be explained considering the smaller particle size and increased surface area; the higher iron concentration in the powders may also be determinant. Enhanced absorption was also observed in the near-infrared range, making the powders even more suitable for sunscreen applications. The green laser was more effective than the infrared one. Overall, laser ablation showed to be a powerful technique to control the size of the sunscreen particles and tailor their optical properties.

KEYWORDS
hydroxyapatite, liquid laser ablation, sunscreen, UV protection

1 | INTRODUCTION

The use of effective sunscreens is the most common method to protect human skin/cells from the dangerous ultraviolet (UV) rays. UV radiations' wavelength falls in the 200-400 nm range; the whole region is divided into three classes, UVA (320-400 nm), UVB (290-320 nm), and UVC (200-290 nm).[1] Such radiations can damage the skin and, in the long term, lead to lethal diseases (ie skin cancer); UVA and UVB radiations are those causing more concern, since UVC are almost completely blocked by the ozone layer in the upper atmosphere.[2]

Sunscreens are generally chemical compounds which can absorb electromagnetic radiation in the UV range; if spread and/or placed in contact with the skin, they absorb these dangerous radiations, hence preventing them to reach

