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The laser furnace: Enabling continuous processing of ceramics and glass under extreme conditions

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Laser processing of ceramics and glass has been proposed as a method to enable a multitude of surface functionalities and unforeseen relevant applications, although laser-induced thermal shock has hindered full use of lasers within these industrial sectors. Most of the former materials suffer cracking and eventually, catastrophic failure as a consequence of accumulated thermo-mechanical stress. In order to avoid this problem, a patented device has been developed which combines continuous laser scanning with uniform movement of the samples across a roller kiln kept under a convenient temperature profile. This unprecedented methodology enables treatment of any surface at extreme temperatures, while the sample's volume is kept at reasonably low temperatures. For example, BaZrO₃ coatings melting near 3000°C have been processed over Al₂O₃ substrates at temperatures around 2100°C or over porcelain tiles at 1140°C, insuring very robust coatings integrated at the atomic scale into the substrate. This talk will present the Laser Furnace models developed so far and will review the most relevant results obtained to date in glass and ceramics.

Biography

Germán F de la Fuente is a Research Professor at the Spanish National Research Council (CSIC) working at the Aragón Institute for Materials Science (ICMA). He started the Laser Applications Laboratory at ICMA about 25 years ago, a reference in Laser Ablation and Melting and has developed large area laser surface coating and modification methods for ceramics, glasses and metals. He is co-inventor of 10 patents, coauthor of 140+ scientific papers and has coordinated a large number of projects based on the use of laser technology developed in his research group.

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