Laser induced chemistry

Germán F. de la Fuente
ICMA, CSIC – Universidad de Zaragoza

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Facultad de Ciencias, Universidad de Zaragoza - CSIC
C/ Pedro Cerbuna, 12. Zaragoza 50009. Spain
CSIC Consejo Superior de Investigaciones Científicas
Universidad Zaragoza
Facultad de Ciencias Universidad Zaragoza

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xerman@unizar.es, http://www.icma.unizar-csic.es/ICMAportal/grupos.do?id=41

Advances in Laser Technology have taken place at a pace similar to electronics, particularly during the past two decades. Lasers which were once very large in size, with high energy consumption requiring intense cooling infrastructure, expensive and in need of beam quality improvement, have given way to new miniaturized devices with high energy efficiency, air cooling and excellent beam quality and reliability.
These new devices are easy to integrate both, in scientific and industrial environments, and, in addition, they offer unprecedented potential towards new developments both, in molecular and solid state chemistry. For example, they enable localized chemical reactions at surfaces to take place under temporal and spatial control, with maximum yield and avoiding the usual thermal activation characteristic of many chemical reaction systems, which requires extensive heating of solid or liquid volumes.
This talk will start with a very brief review of fundamentals which determine how lasers work in pulsed or cw emission, stressing the differences between lasers and other radiation sources, their commercial availability and characteristics which make them interesting for use in a chemical synthesis laboratory. A short description of the basic mechanisms of interaction between lasers and matter will follow, with supportive illustrative examples. The main stream of the lecture will then include a critical discussion of selected research results which illustrate the potential of different types of lasers to perform physico-chemical changes at the molecular, nanostructural and extended solid regimes.

Germán de la FUENTE, Ph.D. in Chemistry is a Research Professor of the Spanish National Research Council (CSIC), working at the Aragón Institute for Materials Science (ICMA/University of Zaragoza- CSIC). He has specialised in developing surface coating and modification processing methods for ceramics, glasses, metals and C nanostructures. He has started the Laser Applications Laboratory at ICMA about 28 years ago, developing Laser induced Zone Melting methods to control solidification and microstructure in both, Superconductor and Eutectic Ceramics. He later established facilities for Laser Ablation of materials with the objective of developing original, large-area surface and coatings fabrication methods, in addition to original C nanostructure preparative techniques based on laser irradiation of graphitic and molecular precursors. His work has attracted attention from several industries, resulting in a large number of projects with Industrial partners at the local, national and European levels. He is the co-inventor of 10 patents, the coauthor of more than 150 scientific papers and has coordinated a large number of publicly and privately funded projects based on the use of laser technology developed in his research group.