

Preface

Lasers in Materials Science is the title of both this book and the Third International School, SLIMS-2012, held on S. Servolo Island, Venice (Italy) from July 8 to 15, 2012.

The selection of topics covered in the book and the combination of didactic introduction to the fundamentals of laser-materials interactions with up-to-date presentation of state-of-the-art techniques and emerging applications of laser processing reflect the content and spirit of the lectures and discussions at the School. One of the goals of this biennial school is to provide Ph.D. students and young research scientists working in the field of laser-materials interactions with robust fundamental knowledge that is often lacking in their training, so that they may profitably interact with colleagues working in areas neighboring their own research fields. The general area of *Lasers in Materials Science* spans fields where the interaction between laser radiation and matter plays a basic role to engineer new materials, or to enhance specific properties, mainly surface related, of irradiated matter. The laser community offers several established International Conferences where young researchers can meet with their peers, exchange experiences, establish collaborations, or display their own results to a qualified audience. However, a structured training opportunity, specifically geared toward young researchers, was lacking before the SLIMS series was established.

Focusing on the strong interplay between experimental and theoretical investigations of laser-induced phenomena, the program of the one-week residential School included 17 lectures on the fundamentals and principles of laser-materials interactions and laser materials processing. The syllabus covered the mechanisms, relevant experimental and computational techniques, as well as current and emerging applications in nanoscience, biomedicine, photovoltaics, analysis, and industry. The topics ranged from laser-surface and -bulk interactions, to the role of defects, nonlinear absorption phenomena, surface melting, vaporization, superheating, homogeneous and heterogeneous nucleation, phase explosion and plasma formation, nanosecond, femtosecond and attosecond laser pulses, film synthesis by pulsed laser deposition, nanoparticle nucleation, growth and assembling, laser nanostructuring of soft matter, development of new light and X-ray sources, free electron lasers, and laser interactions with biological tissues.

One of the distinctive features of SLIMS-2012 was the active participation of students in the activities of the School. This was facilitated by structured

classroom discussions and ample opportunity for students to discuss their ongoing projects or research plans with the School lecturers in informal settings. The students presented posters that were displayed over the School duration in the lecture hall. All posters were discussed during three extensive poster sessions and at coffee breaks. The students also gave brief oral presentations highlighting key points of their research in dedicated sessions and participated in a competition for the Best Student Presentation Award (dedicated to the memory of Prof. Roger Kelly). The School was attended by 36 students from 13 countries, with 25 students coming from EU countries, six from the USA, and four from the Mediterranean Sea area.

All lecturers, coming from both leading research centers and academic institutions, are actively involved in research topics covered by their lectures. The School Directors are grateful to School lecturers for the attention they put in the preparation of truly didactic, though high level, presentations and for the relevant work they did to convert the didactic material into self-contained book chapters that offer excellent reviews of the different topics.

Venice International University (VIU) quarters at S. Servolo Island provided superior lecturing and logistic structures in a pleasant working ambience, immersed in a quiet, beautiful garden, a few minutes from the heart of the city. This confirmed to be strategic for the success of the School.

The positive evaluation of SLIMS-2012 by the participants stimulated the planning of the forthcoming Fourth International School on *Lasers in Materials Science*, SLIMS-2014 that will be held on S. Servolo Island from July 13 to 20, 2014 under the direction of N. M. Bulgakova, Y. Lu, P. Schaaf, and P. M. Ossi.

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