Preface

The ISMART (Engineering of Scintillation Materials and Radiation Technologies) conferences bring together the radiation detector community, from fundamental research scientists to applied physics experts, engineers and experts on the implementation of advanced solutions. This scientific forum builds a bridge between different parts of the community and is the basis for multidisciplinary, cooperative research and developments.

An essential goal of the ISMART conference series is reviewing the latest results, from fundamental studies to various scientific and industrial applications. First of all, it allows monitoring the progress in a broader area than only radiation detection systems engineering. This is the way to examine new theoretical models and their applicability for the search of new scintillation materials and, at a later stage, industrial technologies development. Second, new scientific results and hypotheses provide the engineering community with advances and even exotic detector design and solutions. This dual approach accelerates progress in all directions of radiation detection activity. The aim is to create synergy by bringing together experts from many different scientific fields.

This book presents reports and presentations selected by the Organizing Committee of the ISMART 2016 Conference, which was held in Minsk, 27–30 September 2016. Previous ISMART series meetings were in Dubna, Kharkov and Minsk. It is important to note that the structure of the book in general and the selection criteria are directed to analyzing and extracting the most significant results, reflecting new trends in the field, from fundamental science to detection system engineering, production and application.

The two chapters in Part I are based on invited talks reviewing the microtheory of scintillation development in inorganic material and the latest developments in measuring superfast (sub-picosecond domain) processes at the earliest stages of energy relaxation in a scintillator. Both presentations cover recent developments and describe both newly available techniques and experimental limits.

Part II includes topics showing the potential for developing scintillation materials and describing new ideas on high light yield scintillator development.

The chapters in Part III are devoted to technological improvements and alternative technological solutions. Simultaneously, problems with conventional halide, oxide and organic scintillators, and new approaches for radiation detector technology were proposed and evaluated—in particular, the low-cost, platinum-free technology of skull technique for large-size scintillation crystal growth, technology of the glass-ceramic materials and flexible composite scintillators development.

In Part IV, the most interesting detector engineering presentations are described. For many years, the driving force has been High Energy Physics (HEP) instrumentation. LHC (Large Hadron Collider) projects show examples of very complex, but at the same time sophisticated detectors engineering. Within the scope of ISMART 2016, we had the opportunity to listen to reports on a novel design for the next generation of LHC and FCC (Future Circular Collider) detectors and neutrino experiments. There are new designs for projects at other accelerators. A new tendency in detector engineering is the cryogenic detector for simultaneous photon and phonon detection, operating at milliKelvin temperatures.

Part V demonstrates the progress in detecting systems engineering and special applications in conventional fields. Two applications that dominated the recent market were selected. First, we have new detectors and new approaches for oil well logging and other geophysical applications. The second direction is security application with potential solutions in X-ray scanners for visual cargo monitoring systems and introscopic systems intended for personal inspection. It was shown that the ongoing relevant instrument engineering is an incentive for rapid development of new scintillation materials and techniques, and their applications.

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