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Research Advances into Mine Safety Science and Engineering

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Mine safety has increasingly received more attention in the last few decades by researchers, scientists, and practitioners. Due to its importance, it may be argued that safety has become the fourth pillar of mining sustainability [1], being an integral part of economic, environmental, and social impact studies of new mining projects. The discipline of safety science and engineering is quite broad, and it extends to many industries other than mining. It may be classified into three main subjects − human perception and adoption of safety culture, development of safety assessment methods, tools, and techniques, and safety management and practice. The human ability to identify and react to safety hazards is the first and crucial step towards successful implementation of safety in the workplace. Much research is being done on safety culture development, training, and improvement [2−4]. For example, virtual reality-based programs have been developed as a safety training tool in the mining industry [5,6].

The second subject and perhaps most of the research on mine safety lies with its technical and technological developments. The scope of application is diverse, encompassing open-pit mining, quarrying, soft and hard coal mines, metal mines, and others. In coal mining, for example, soft coal mines suffer from coal and gas outbursts [7,8], dust explosions [9], fire [10,11], whereas hard coal mines suffer from rockburst phenomena associated with roof and pillar burst and coal bumps [12−14]. Metal mines continue to dig deeper and suffer from strong seismic activity creating severe rockburst events [15]. Deep mines have reached some 5 km in South Africa [16], and 3 km in North America [17]. Even metal and coal mines at much shallower depths have reported severe seismic activities and rockburst phenomena [18,19].

Technological advances in wireless communication, laser, radar, and fiber optics, among others have helped a great deal in introducing a wide range of safety tools in the mining industry. Underground mining equipment such as production drills and load-haul-dump vehicles can now be remotely operated from the surface. Tracking tools are widely used to locate miners and equipment underground [20]. Wireless sensors communicate crucial information from underground to the surface such as temperature, humidity, airflow velocity, and hazard gas content. Microseismic networks are now being used not only to monitor seismic activities and obtain seismic source parameters, but also as tools for rockburst early warning [21]. In general, there is a strong move towards digitalization and automation in the mining industry, both surface and underground, with safety as the main driver for such decisions.

This Special Issue is a collection of papers presented at the 5th International Symposium on Mine Safety Science and Engineering held in the historic city of Katowice in Poland, November 21−24, 2021. The symposium is a forum for the exchange of knowledge, information, and experiences gained in different areas of research and practice in mine safety. This symposium series was launched in 2011 after the University of Science and Technology in Beijing and McGill University joined efforts to create it. Since then, the series has quickly grown and attracted international interest from Europe, Asia, Australia, and North America. The symposium was subsequently held in 2013, 2016, and 2018.

We would like to express our sincere gratitude to our colleagues on the Scientific Review Committee, who took the time to evaluate and select papers for this Special Issue from a list of many papers

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presented at the symposium. More than 110 presentations were made at the symposium – both in person and online. In collaboration with the Scientific Review Committee, authors of the best presentations were invited to submit full-length papers for publication in the Journal of Sustainable Mining. This special issue represents a status update in the field. We hope that the readers will find it interesting.

All papers were subjected to a rigorous review process by at least two reviewers, in accordance with the high standards of the Journal of Sustainable Mining. On that, we wish to thank Adam Smolinski, Editor-in-Chief, for allowing us to publish this Special Issue. Special thanks are due to Stanislaw Prusek, the Symposium Chair for leading the organization of such a great event.

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