Preface

In 2019, we celebrated the 100th anniversary of the AGH University of Science and Technology in Krakow. This special issue of CMMS is an excellent opportunity to present the achievements of the employees and doctoral students of the Department of Heat Engineering & Environment Protection of the Faculty of Metals Engineering and Industrial Computer Science in research and teaching.

The beginnings of the Department go back to almost the foundation of the University and the Faculty. On 1 May 1922, the Senate of AGH University of Science and Technology in Krakow singled out metallurgy as a field of study and appointed the first Council of the Faculty of Steelmaking. Carrying out research and teaching high-temperature processes required the academic potential of the University to be enhanced and so, on 2 January 1925, the Department of Thermal and Fuel Engineering was established as a result. In this period, employees of the Department worked on projects for the emerging industry of the Second Republic of Poland, and taught classes on hard coal combustion, heat transfer, and thermal equipment. In 1952, the Senate of AGH changed the name of the Faculty of Steelmaking to the Faculty of Metallurgy, and subsequently, in 1959, an independent Department of Steelmaking Furnace Construction was formed. In this period, it became possible to award diplomas to specialists in furnace construction and revamping as part of the Furnace Construction major taught by our lecturers. In 1965, the Council of the Faculty of Metallurgy adopted a resolution on merging both Departments into the Department of Thermal Management and Furnace Construction. The further reorganization of the Department led to the formation of the Division of Thermal Technology and Industrial Furnaces in 1967. In the 1990s, due to a change in the field of research and teaching brought about by the needs of the labor market and the economy, the name was changed to the Division of Thermal Technology and Environmental Protection. The current name was adopted under the Resolution of the Senate of AGH of 28/03/2007.

The fields of research pursued in the Department in recent years include a broad scope of topics and are strictly related to the progress in science and the problems faced by contemporary industry. The structure of the Department includes research teams focusing their research on the identification of boundary conditions of heat transfer in fluid cooling processes and contact effects, the application of cellular automata methods, and the Lattice Boltzmann Method to model processes and phenomena related to additive manufacturing with a change in the state of aggregation, and fluid flow. The structure of the Department also comprises teams dealing with the analysis of thermal processes of solid fuels and waste. As part of the research conducted, issues related to heating charge in heat furnaces, and balancing thermal processes, are still continued. In the pages of this special edition of the journal, we want to present the selected research works of our scientists which reflect their academic activity. Two papers are devoted to the identification of heat transfer conditions in cooling processes with surface boiling, using various methods of fluid feeding. The presented results are relevant for industries where cooling is one of the manufacturing processes. The findings presented concern research using an innovative solution to enable a local change in the amount of heat transferred to be assessed. A good understanding of cooling methods and the accompanying mechanisms of heat transfer will enable higher cooling rates and uniform temperature distribution to be achieved during the process. The development of modern technologies concerning the cooling process is one of the primary challenges to the economy because it enables large heat fluxes to be transferred, larger than in other conventional cooling methods. The subsequent paper discusses the issues related to heat transfer between two contacting surfaces. These issues are very relevant in steel manufacturing and processing during, among others, contact of the strand with cooled rolls or the material forged with dies. The surface condition, the presence of the oxidized layer or additional substances, and the force applied significantly impact the process dynamics. The

paper presents the findings of experimental research on the impact of the steel type and the applied pressure on the density of heat flux transferred between the surfaces. The next paper describes issues related to an increase in scale thickness during high-temperature heating processes. Scale substantially affects the heating time, causing an increase in heat consumption; during the metal forming process, it can be imprinted in the material surface and damage the product. The experiments presented in the paper allowed the authors to create a mathematical model of scale build-up. The formulated model provides high-quality results of scale thickness development versus the time the charge stays in the furnace depending on the atmosphere temperature. It can be successfully used for numerical computing. In this special issue, you can also read a paper mentioning the possibilities of using the innovative Lattice Boltzmann Method. This method can be applied for mathematical modeling of processes and phenomena occurring during gas and fluid flows. It is becoming increasingly recognized in the academic community.

We hope the presented papers will inspire readers of the journal to develop research on the presented findings and contribute to the establishment of academic collaboration with the employees of our Department.

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