TMS 2020 Annual Meeting & Exhibition Report

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The TMS 2020 Annual Meeting and Exhibition took place at the San Diego Convention Center between February 23 and 27 in San Diego, California. This year's TMS was attended by 4681 attendees, making it the best attended TMS annual meeting in its 149-year history. The attendance would have been higher – over 200 researchers from China could not make the meeting because of domestic and international travel restrictions due to COVID-19. The coronavirus was also felt at the meeting, with many hand sanitizer dispensing stations located inside the convention center. Still, the virus was not the dominant force that it soon became. Friends greeted each other by shaking hands. Poster sessions were well attended. During lunch and dinner hours, scientists of all ages and nationalities were spotted in the restaurants of the Gaslamp District, enthusiastically discussing their work and life in their language of choice. Everything was normal, with only a slight trace of tension in the air.

The organization of this year's TMS meeting was led by TMS President James Foley of the Los Alamos National Laboratory, TMS Board of Directors, and TMS Programming Committee. It featured 89 technical symposia, including the 9th International Symposium on lead and zinc processing (PbZn) that co-located with TMS 2020. The total number of abstracts exceeded 5100, again a record for TMS. The main themes of TMS 2020 can be captured by a word cloud (Figure 1). While the scope of TMS encompasses the entire range of materials science and engineering, the current foci of interest in the TMS community include energy materials, additive technologies, advanced characterizations, machine learning, and modeling of materials science, engineering, and processing.

X-ray and neutron techniques that are closely aligned with the scientific thrust of Powder Diffraction are well represented at TMS 2020. In addition to laboratory X-ray measurements that have become a staple of materials characterization, *in situ* and *operando* studies facilitated by the expansion of measurement capabilities at large synchrotron-based X-ray user facilities and neutron user facilities around the globe are becoming increasingly popular and serve to unveil deeper connections between materials structures, processing, and their functional properties. For example, a full four-day X-ray and neutron symposium was dedicated to the development of additive manufacturing technologies, where the high-speed X-ray diffraction and imaging experiments at measurement speeds as high as 10 000 Hz were highlighted. Such cutting-edge measurements enable the detailed characterization of melt-pool evolution and its associated phase transformation driven by rapid solidification in the highly nonequilibrium and heterogeneous processing conditions of additive manufacturing, providing a pathway to rational design and optimization of industrially important additive technologies.

Applications of machine learning (ML) have become commonplace in materials science, aided by recent rapid development in data and informatics science. Diffraction techniques, because of the large amount of existing data and comprehensive database, their ability to acquire new data rapidly, and the relative ease in data classification, are among the characterization techniques that receive the most ML attention. This was appropriately reflected at TMS 2020 with a symposium dedicated to structural descriptors, data-intensive techniques, and uncertainty quantifications related to ML. This symposium demonstrated the importance of validation of ML algorithms by experiments and their potential of assisting scientists on their routine duties such as on-the-fly crystal structure identification of XRD data, thus providing scientists with a chance of focusing on producing better science.

Prior to the main meeting, five professional development workshops took place on Sunday, February 23. They were Zinc Processing; Advanced Microelectronics Packaging, Interconnection Technology, and Pb-Free Solders; Modeling the Coevolution of Microstructure and Properties using the MOOSE Framework; Lead Processing; and Additive Manufacturing Materials and Processes.

TMS also welcomed its 2020 class of Fellows. The eight newly inducted TMS Fellows are Mark Asta of University of California, Berkley; Rodney Boyer of RBTi Consulting; Marc De Graef of Carnegie Mellon University, Diana Farkas of Virginia Polytechnic Institute and State University; Dorte Juul Jensen of Technical University of Denmark; Karl Ulrich Kainer of Institute of Materials Research of Germany; David McDowell of Georgia Institute of Technology; and Neville Moody of Sandia National Laboratory. Among these Fellows, Prof. De Graef is a renowned expert on electron diffraction and Prof. Jensen made seminal contributions to the understanding of physical metallurgy using X-ray, neutron, and electron diffraction techniques.

The 2020 TMS-AIME Awards Reception and Ceremony took place on Wednesday, February 27. Over 15 named TMS awards and 14 Divisional awards were presented to the awardees. More details about the awards can be found on TMS's website as well as the February issue of JOM (Bohnert, 2020).

Thirty-four technical committees, including the Additive Manufacturing Bridge Committee, across four TMS divisions (Extraction & Processing Division, Functional Materials Division, the Light Metals Division, Materials Processing & Manufacturing Division, and the Structural Materials Division) held their committee meetings during TMS 2020. Common committee agenda included review of symposia for TMS 2020, selection of symposia for TMS 2021 and MS&T 2021, and election of new committee leadership and members.

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Figure 1. Word cloud describing the main themes of TMS 2020. The keywords are extracted from the titles of all symposia. The font size is proportional to the square root of the appearance frequency of the top 25 keywords.

The Exhibition is always an important component of the TMS annual meeting, complementing the scientific program. This year was no exception. A total of 76 exhibitors displayed their latest products and services from Monday, February 24 to Wednesday, February 26. The international exhibitors included vendors of analytical instruments, software and database service providers, industrial mining and milling companies, analytical laboratories, scientific publishers, professional societies, and government laboratories, allowing conference attendees to make various types of business contacts in one convenient location.

TMS 2020 also experimented with several new concepts to make the conference experience more rewarding. For example, 10 channel headphones were utilized in so-called silent sessions, which allowed up to 10 presentations to happen simultaneously within the same conference area and enabled the audience to choose and switch to the topic of their interest. Invited posters were also introduced to TMS for the first time, with the goal of having more well-known experts getting engaged in the stimulating and in-depth discussions that poster sessions can better afford.

Soon after TMS 2020 concluded, the scientific conferencing world ground to a halt due to the spread of coronavirus SARS-CoV-2. TMS 2021 Annual Meeting & Exhibition is scheduled to be held between March 14 and 18, 2021 in Orlando World Center Marriott, Florida. While it is not clear if large gatherings such as TMS annual meeting will be allowed one year from now, we can do our share to unite around the common goal to defeat this virus. Encouragingly, since the outbreak, the international diffraction and scattering community have rapidly mobilized to solve the structure of coronavirus SARS-CoV-2, a first step toward vaccine and drug development. From the Diamond Light Source in Oxfordshire, UK, to the Advanced Photon Source in Lemont, USA, to Elettra Sincrotrone in Trieste, Italy, to the Shanghai Synchrotron Radiation Facility in Pudong, China, macromolecular X-ray scientists and the synchrotron support staff are working tirelessly to understand how the virus functions and replicates, to identify the binding site of SARS-CoV-2 protease, and to expedite drug discovery through macromolecular-crystallography-based fragment screening tests of SARS-CoV-2 crystals. This pandemic is a danger to all humanity and must be solved through the collective effort of all countries. For this, the diffraction community has set a great example.

"Don't walk in front of me, I may not follow; don't walk behind me, I may not lead; Walk beside me and just be my friend." In this time of crisis, through international collaboration, determination, and perseverance, together, we shall overcome.

Bohnert, A.-A. (**2020**). "A mark of excellence: The 2020 TMS award recipients," JOM **72**(2), 585–600.