

## **Women in Mathematics of Materials Workshop**

Materials Science is an interdisciplinary field that focuses on the discovery and design of new materials. Mathematics plays a fundamental role when developing models that describe the processing, structure, and properties of materials. During the SIAM Conference on Mathematical Aspects of Materials Science in Philadelphia in May 2016, Hala AH Shehadeh (James Madison University), Malena Espanol (The University of Akron), and Maria Emelianenko (George Mason University) organized a Women in Mathematics of Materials (WIMM) networking luncheon in cooperation with the Association for Women in Mathematics (AWM) and the support of the SIAM Activity Group on Mathematical Aspects of Materials Science (SIAG/MS). Approximately forty female researchers at different levels in their careers attended the event. There was an overwhelming sentiment at the luncheon to develop a strong and active community for women in this area and a support structure to help women advance their research. Women in other applied fields have benefited from the existence of such communities, but there had not been cohesive efforts before in Mathematics of Materials. The compelling need for such an effort is the severe underrepresentation of women at major research conferences and workshops in the materials science area. For example, out of the total number of speakers at conferences such as the SIAM Conference on Mathematical Aspects of Materials Science, fewer than 15% are women. This is mainly due to the low-representation of women in the field, and it is amplified by the challenges that women, in particular, face in maintaining active research programs while caring for their families, securing funding and traveling to disseminate their results.

With that in mind, Hala AH Shehadeh, Malena Espanol, and Petronela Radu (University of Nebraska – Lincoln), encouraged by AWM president Amy Radunskaya (Pomona College), organized a workshop to support and expand research efforts by female mathematicians in the field of materials science. With financial support provided by the Michigan Center for Applied and Interdisciplinary Mathematics (MCAIM) at the University of Michigan – Ann Arbor, and the support of its director John Schotland, and with partial support from AWM NSF ADVANCE grant and James Madison University, the MCAIM-WIMM Workshop was held at the University of Michigan – Ann Arbor, on May 14-18, 2018.

The workshop consisted primarily of several groups working on problems in materials science. Each group was composed of junior female researchers led by a senior female investigator. This structure benefited all participants: the senior researchers had the opportunity to showcase and propose research projects around critical problems in the field of materials science, while junior women (tenure track faculty, post-docs and advanced graduate students) worked on new areas and recent advances in the field. This collaborative workshop inherently facilitated the formation of new collaborative research groups that will continue to advance the field long after the workshop. There were five research project groups:

- “Liquid Crystals with Applications to Biology” lead by Maria-Carme Calderer (University of Minnesota) and Robin Selinger (Kent State University), and junior group members Malena Espanol, Lidia Mrad, Eleni Panagiotou, Ling Xu, and Longhua Zhao.
- “Fluid Driven fracture in Poro-elastic Media” lead by Yekaterina Epshteyn (University of Utah) and Pania Newell (University of Utah), and junior group members Lei Cao, Amanda Howard, and Hala AH Shehadeh.
- “Machine Learning for Predicting Mechanical Response of Polycrystals” lead by Marisol Koslowski (Purdue University) and junior group members Siwei Duo, Cindy Wang, Somayyeh Sheikholeslami, and Katerine Saleme.
- “Materials Science and Differential Geometry” lead by Marta Lewicka (University of Pittsburgh) and junior group members Silvia Jimenez Bolanos, Xiaochuan Tian, and Anna Zemlyanova.
- Local and Nonlocal Models in Materials Science by Petronela Radu (University of Nebraska – Lincoln) and junior group members Marta D’Elia, Cynthia Flores, Helen Li, and Yue Yu.

There were also four 1-hour plenary talks given by experts in the area of materials science:

- “Mathematical Analysis of Novel Advanced Materials” by Irene Fonseca (Department of Mathematics, Carnegie Mellon University)
- “Complex Crystal Structures in Hard and Soft Condensed Matter” by Julia Dshemuchadse (Chemical Engineering Department, University of Michigan – Ann Arbor)
- “Elastic Networks and Topological Mechanics” by Xiaoming Mao (Physics Department, University of Michigan – Ann Arbor)
- “Diffuse Interface Methods in Materials Science & Engineering” by Katsuyo Thornton (Materials Science and Engineering Department, University of Michigan – Ann Arbor)

The workshop included poster presentations, networking coffee breaks and lunches, a banquet, a group hike and four panel discussions addressing personal and professional issues that are of concern to women in mathematics such as: dealing with negative reviews, editorial work, mentoring, and grant writing. The workshop concluded with oral presentations given by each group on the progress of the projects and future work.

As follow up events, there will be special sessions for the WIMM Research Network to showcase the results of this workshop at the AWM Research Symposia to be held at Rice University, Houston, TX, April 6 - 7, 2019 and the AWM Workshop at the SIAM Annual Meeting to be held in Toronto, Ontario, Canada, July 6-10, 2020.

The second networking luncheon for the WIMM research network will be held on Wednesday July 11, 2018, during the SIAM Conference on Mathematical Aspects of Materials Science in Portland, OR.