

NSF-PIRE PDC NEWSLETTER

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CREATING A CULTURE OF INNOVATION

This year marks final year of the five year NSF PIRE project. What started out as an idea to innovate ceramic fiber production in the US has led to creation of the PIRE precursor derived ceramic or PDC network which now covers emerging topics such as additively manufactured ceramic matrix composites and battery electrodes.

Thus far, 16 graduate students have contributed to various aspects of the PIRE project of which 5 are PhDs and 3 Masters. Another 6 students are expected to complete their PhDs in the coming year, which will be the no-cost extension year of the grant. In addition, 35 undergraduate students conducted research either as research abroad during the summer weeks or as hourly lab assistant during the academic year. US partners have hosted 5 visiting scholars from Italy, Brazil and India over the course of the project. We are grateful to each and everyone of you!

We strive to keep growing this community by building on what we have accomplished thus far.

Prof. Gurpreet Singh, PIRE PI

ALEX CELEBRATES THE OPENING OF MotU

Prof. Navrotsky's Materials of the Universe (MotU) center had its pandemic-delayed grand opening in September of this year. Attendees were given an overview of the center's achievements and plans, tours of lab spaces, and lectures on a range of topics.

The center has also received funds from the NSF for a lab. The lab, called FORCE — Facility for Open Research in a Compressed Environment — will be a one-of-a-kind, high-pressure facility where researchers can observe the impact of extreme pressures and discover new materials.

Congratulations, Alex!



Alexandra Navrotsky speaks during the center's grand opening

RECENT PIRE GRADUATES

This year, two graduate students successfully defended their PhD thesis.

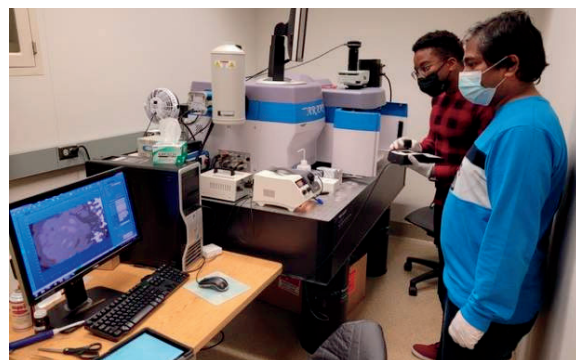
Shariq Haseen whose major advisor is Prof. Peter Kroll, defended his PhD dissertation titled "Computational materials chemistry: from polymer precursors to ceramics and high-pressure materials", at UT Arlington in August of this year.

Shakir Bin Mujib, whose major advisor is Prof. Gurpreet Singh, defended his PhD dissertation titled "Advanced Covalent Ceramics from Organosilicon Polymers for Sustainable Energy and Environment", at K-State in July of this year.

Congratulations, Shariq and Shakir, we wish you the best for all your future endeavors!



Shakir is all smiles after successfully defending his PhD dissertation



Lokesh and Gerson look at Raman microscope images

STUDENTS CROSS TRAINING AT PARTNER INSTITUTIONS

Gurpreet Singh and David Marshall hosted students from partner PIRE institutions. The students were able to gain hands on experience on parts of the PIRE thrusts that they may not have been familiar with. The cross training helped the students gain a deeper understanding of the overall goal of the PIRE project.

Prof. Singh's lab hosted undergraduate student researchers Hannah Hayes and Takhya Holley over Spring break. These student researchers are part of Prof. Peter Kroll's research group from University of Texas Arlington. The students were trained to mount samples for electron microscope analysis. Graduate student Gerson Leonel, representing Prof. Alex Navrotsky's research group from Arizona State University visited Singh's lab to gain hands on experience in PDC powder synthesis training.

Prof. Marshall's lab hosted former graduate student Shakir Bin Mujib and UG students Hildana Abamegal and Mohammed Rasheed from Kansas State University. Hildana spent her summer in Marshall's lab and learnt about optimization of the polymer infiltration process, while Mohammed and Shakir trained on X-ray micro CT of ceramic matrix composite samples.

FIFTH ANNUAL PIRE MEETING



Time for a quick photo shoot in between seminars

The fifth annual NSF PIRE PDC workshop was hosted in a hybrid format in conjunction with graduate school Technische Universität Darmstadt, or TU-D, from July 31–Aug. 7 in Austria. The workshop covered topics in the field of PDCs, high-temperature CMC materials, additive manufacturing of ceramic composites, PDCs for energy storage, and other ultrahigh-temperature materials for aerospace applications.

The project team from the United States was led by Prof. Gurpreet Singh, while the European portion of the workshop was managed by Prof. Ralf Riedel from TU-D. Three German research institutes participated in the workshop: TU-D, Karlsruhe Institute of Technology, or KIT, and DECHEMA Research Institute, or DFI.

Nine graduate and 5 undergraduate students participated from the U.S. side, while 13 doctoral students from KIT, TU-D, and DFI, presented and discussed their research in context with the research program of the PIRE group devoted to high-temperature ceramic fibers. Industry participation was represented by attendees from the General Electric company, Niskayuna, New York and BJS ceramics, Germany.

NEWS FROM THE PIRE WORLD

- Prof. Singh and graduate student Shakir Bin Mujib received the Nanomaterials and Energy Prize for 2021. The prize is offered by the Institution of Civil Engineers, UK. Shakir Bin Mujib's work on SiOC Electrodes For Electrochemical Energy Storage received Second Place Award at the 2022 ICACC meeting best poster award.
- Prof. Himanshu Jain from Lehigh University participated in the National Day of Glass Conference and was featured on the cover of the May 2022 issue of ACerS bulletin.
- Gerson Leonel passed his candidacy exam and published his first manuscript entitled "Thermodynamic Stabilization of Crystalline Silicon Carbide Polymer Derived Ceramic Fibers" in the International Journal of Ceramic Engineering and Science.
- Prof. Chrystelle Salameh is a member of the organizing committee of ISIEM2023, which will be held in Montpellier, France from 19-23 June, 2023.
- Prof. Paolo Colombo (PIRE post-award partner/affiliate) was nominated as President of the International Ceramic Federation. He was awarded the CICC Special Contribution award by the Chinese Ceramic Society, and the 2023 Bridge Building Award by the ECD (American Ceramic Society).
- Prof. Paolo Colombo along with other PIRE partners Alex Navrotsky, David Marshall, and Ralf Riedel, were included in the 2022 Stanford University Rankings list featuring the top 2 per cent scientists around the world.
- Graduate student Lokesh Vendra, who is co-advised by Prof. Gurpreet Singh from K-State, and Prof. N.V. Ravikumar from IIT-Madras, delivered the Keynote lecture at the MSE congress in Darmstadt Germany.

This PIRE project is blessed to have many high caliber students participate in the program, we strive to continue attracting many bright students in the years to come. It is encouraging to see that students are interested in working on PDCs. As we move into the twilight years of this project, we hope that we will be able to continue building on what we have worked so hard to create.

Looking forward to next year, we are very excited to see our program grow. We have laid an amazing platform this year on which we are continually building. We are looking for new funding opportunities to build on the success of the PIRE project. Our next workshop will be held at the Darmstädter House in Hirschegg, Austria (which happens to be part of TU-Darmstadt), from June 26 to July 01, 2023. This will be a great opportunity for us to continue networking with many of our European and international partners.

Season's greetings and warm wishes from all of us in Kansas. We hope you wrap up the year on a high note and have a wonderful winter break with your family and cherished ones. Stay strong, stay safe, and we wish you a wonderful holiday season!

Sailesh Menon

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