PIRE

SYNTHESIS • NANOSTRUCTURE • PROPERTIES
POLYMER-DERIVED CERAMIC FIBERS

FIRST ANNUAL NEWSLETTER

December 2018

Dr. Rishi Raj presents at the 2018 MRS Fall Meeting and Exhibit in Boston, MA, Nov 25-30

ALL ABOARD

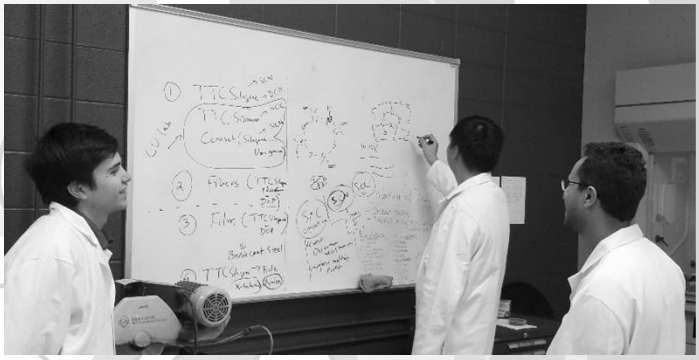
The NSF-PIRE grant has propelled our research into high gear.

Finish reading on PG. 2

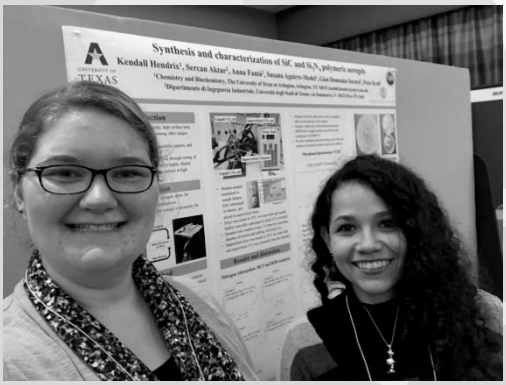
ALEXANDRA NAVROTSKY

Alex's achievements are numerous. Here is the short version.

Finish reading on PG. 3



Zhongkan Ren (middle) teaches Ben Robles (left) and Aly Badran (right) from Raj and Marshall's group about the pyrolysis of PDCs during their visit to K-State



Kendall (left) and Susana from Dr. Peter Kroll's group present their research at SWRM 2018 in Little Rock, AR

SPACE BOUND PDCs

PDCs created in Gurpreet Singh's lab could be traveling to outer space. Find out why……

Finish reading on PG. 3

KANSAS STATE UNIVERSITY · UCDAVIS UNIVERSITY OF CALIFORNIA · University of Colorado Boulder · UNIVERSITY OF TEXAS ARLINGTON · LEHIGH UNIVERSITY · MIT

ALL ABOARD

This year has been catalytic for research on Polymer Derived Ceramics (PDCs) in the U.S., thanks to the NSF-PIRE grant. Our partners and collaborators come from different backgrounds and work cohesively as a unit. Thank you for being a part of this dynamic group! Our community keeps growing, with new collaborators, students and private and public companies coming on board. Here are a few highlights from this year- ***Dr. Gurpreet Singh***

PIRE co-PI **Dr. Alexandra Navrotsky** organized a 2 credit hour seminar course in the Spring Semester (EMS 289c Spring 2018 A). The seminar series was live streamed via Zoom, for students and audiences across the globe. The video recordings and slides can be accessed at: https://thermo.ucdavis.edu/glasses-amorphous-materials-seminar-ems-289c-spring-2018/

Five undergraduate and two graduate students in the PIRE program had the opportunity to pursue their research in Europe through the research abroad experience. The students traveled to PIRE partner institutions in France (University of Limoges and Sorbonne University), Italy (Institute of science and technology for ceramics [ISTEC], University of Padova, and University of Trento), and Germany (Technical University of Darmstadt [TU-Darmstadt]), where they were mentored by world renowned experts in the field of PDCs. Outside the laboratory setting, the students were able to interact with locals and gain a deeper understanding of European culture and values.

The **first annual NSF-PIRE-PDC workshop** and retreat was held at Kansas State University from July 16th-18th, 2018 at the K-State Alumni Center. The workshop had over 45 attendees with more than 25 speakers covering a wide range of topics.

Three scientific papers were published in peer reviewed journals. **Dr. Singh** was awarded Patent No. 9,908,905, for his work titled, "Aluminum-Modified Polysilazanes for Polymer-Derived Ceramic Nanocomposites."

Dr. Samuel Bernard from University of Limoges organized a symposium on PDCs at the 7th International Congress on Ceramics (ICC7), which was held from June 17th-21st, 2018 in Foz do Iguaçu, Brazil. **Dr. Philippe Miele** from University of Montpellier, France, delivered the keynote lecture at Materials Science and Engineering 2018 (MSE), which was held from September 26th-28th, 2018 in Darmstadt, Germany. **Dr. Ralf Riedel** from TU-Darmstadt was the co-organizer of the MSE Congress; he also chaired a session at the MSE Congress.

THE INCREDIBLE ALEXANDRA NAVROTSKY

Dr. Navrotsky has traveled to China (twice), Germany (twice) and Mexico. It has been a year of celebrations for her. A university-wide lecture at Shanghai Xiaotong University, and a symposium and dinner honoring her 75th birthday at the Goldschmidt geochemistry conference in Boston, amongst many other things.

Alex enjoying downtime with Tahoe (closest to her), L to R Redi, Winner and Luna

She has endowed an American Ceramic Society award in thermodynamics. The Navrotsky Award for Experimental Thermodynamics of Solids will be awarded every two years for the author who makes the most innovative contribution to experimental thermodynamics of solids. The winner will receive a certificate, a $5000.00 prize and will be expected to present a talk at the conference at which the award is made. She is also proactively supporting the new Consortium in Thermodynamics, which will address thermodynamics in materials science.

Dr. Navrotsky has been appointed to the California Council on Science and Technology (CCST) Board of Directors, which provides strategic vision and direction for CCST. She spends her leisure time at home with her four dogs- Tahoe (12 yrs), Reditu (6 yrs), Winner (6 yrs) and Luna (4 yrs).

SPACE BOUND PDCs

National Aeronautics and Space Administration (NASA), via Task Orders issues by the International Space Station (ISS) Program Office at Johnson Space Center, has agreed to provide funding for a proposal submitted by Made in Space (MIS). MIS proposed to develop payloads for manufacturing small turbine blisks that would benefit from the unique properties imbued on parts manufactured in a microgravity environment. NASA has agreed to sponsor two MIS pilot payloads towards turbine engine development. One of the payloads is for manufacturing ceramic parts from a pre-ceramic polymer. This payload will test suitability of pre-ceramic polymers developed in **Dr. Singh's** lab for 3-D printing in space. This unique material is derived from the NSF-PIRE funded ceramics research.

"I am very excited for the future of PDCs and the camaraderie that being part of such a huge collaboration brings"- Gurpreet Singh

UPDATES FROM OUR PARTNERS

Our partners across the globe are answering many questions, it is hard to list all of their accomplishments in a newsletter. Here are a few of their incredible achievements-

Dr. Himanshu Jain has been recognized as the Founding Director of Institute for Functional Materials and Devices (IFMD), at Lehigh University. He is reaching out to its faculty in different departments to make them aware of the PIRE program and its expertise.

Dr. Elsa Olivetti has been promoted to Associate Professor. She recently published a paper on manufacturing scalability in clean energy and materials-intensive technologies, the work provides the overall framework for her group's efforts in the PIRE program.

Dr. Navrotsky and **Dr. Ralf Riedel** attended the "Spinel and related materials" workshop in Rudesheim, Germany.

Dr. Ralf Reidel was the co-organizer of the MSE Congress in Darmstadt, Germany. He also chaired a session at the Congress.

Dr. Chrystelle Salameh has 2 new PhD fellows that joined their group working on PDCs (but not on fibers).

Dr. Christel Gervais attended two conferences, one in Daytona, FL and the other one in Foz de Iguaçu, Brazil as an invited speaker. She has published two papers in the field of PDCs with other PIRE members recently.

Dr. Masaki Narisawa received two-year funding (October, 2018- March, 2020) from "Japan Science and Technology agency" with the program of A-STEP (Adoptable Seamless Technology transfer Program through target driven R&D), for his work titled- R&D of Ankle-Foot Orthosis on the Basis of Kicking Dynamics – "Establishment of Processing Technology for Stable Walking Performance."

Dr. GianDomenico Soraru delivered a lecture at Osaka Prefecture University on 19th March, 2018. The title of his talk was "Synthesis and Characterization of SiOC Porous Materials by Precursor Method".

Dr. Paolo Colombo signed four research contracts with industry and was awarded one EU project and one national project. He has also been working on Industry-classified work on Additive Manufacturing of ceramics.

Dr. Philip Miele delivered the keynote lecture at the MSE Congress in Darmstadt, Germany.

Sailesh Menon will be attending a NSF workshop on Best Practices in International Research Experiences for Graduate Students in January.

Final thoughts from the Project Administrator- Sailesh Menon

Another amazing year has whizzed by. It seems like yesterday that I was working at the K-State College of Veterinary Medicine as a Laboratory Administrator. A new journey has begun for me since I started working at the College of Engineering; I am very grateful for the opportunity presented to me by Dr. Gurpreet Singh and the NSF. In my role as Project Administrator, I have had the opportunity to interact with PIRE members via email and/or personally, I will always treasure the connections. It's been serendipitous to be part of the program since its inception and presented with the opportunity to make my mark on it. From coordinating international travel for students in the program, and running the logistics for the annual workshop, to NSF reporting and everything else in between, it has been a state of constant learning, which no amount of schooling can prepare you for.

On the home side, things are crazy busy and steady at the same time. My son, Surya, is halfway through 5th grade and keeps getting taller. He started the year frantically solving Rubik's cubes (best official time of 17 seconds for a 3x3 mix-up at a world cubing association competition) and is ending the year obsessively practicing the French horn. It is amazing to see how quickly he grasps concepts, which from the outside seem very different, but are fundamentally the same. Of course, none of this would have been possible without the support of my amazing wife, Jaime, who is the glue of our family. It is said that behind every successful man is a woman. For me, I would have to say, I have achieved success because I have my wife beside me every step of the way.

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. The program is getting stronger with each passing day as we are networking and collaborating more than we did when the grant first started. Next year, we look forward to seeing familiar faces and many new faces. At the next workshop, hopefully the weather will co-operate and give us a chance to explore the Konza prairie on a grander scale. With Rishi's 75th birthday on the horizon, plans are afoot to make it a memorable one.

Surya is excited about the first good snow of the season

Happy Holidays and I hope everyone gets to spend quality time with their cherished ones. The greatest gifts for me are family, health, and time; I hope each of you find what is important to you.

Best wishes,
Sailesh Menon

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