

- 1. Dr. Dean Webster** – High Performance Bio-based Thermosets
Professor and Chair, Coatings and Polymeric Materials
North Dakota State University; Fargo, ND
Within the Center for Sustainable Materials Science (CSMS) research, the Webster research team is carrying out research on high performance thermosets derived from bio-based resins having unique molecular architectures. The group synthesizes resins with reactive functional groups, and then crosslinks these to form hard, rigid materials. Due to the unique molecular architecture and high functional group concentration, the thermosets are highly cross-linked and have properties comparable to petrochemical based thermosets. The thermosets can be used in applications such as coatings, adhesives, and composites.
- 2. Dr. Mukund Sibi** – Polymer Synthesis, Programmed Degradation of Polymers
Distinguished Professor, Chemistry and Biochemistry
North Dakota State University; Fargo, ND
Research in the Sibi group is focused on the development of novel methods for the conversion of renewable resources to feedstock chemicals for use in polymer synthesis and programmed degradation of polymers. In our work we have use three important renewable materials (1) oil seeds, (2) cellulose, and (3) lignin. In particular, we are investigating novel methodologies for the synthesis of linear dicarboxylic acids and application of 5-hydroxymethyl furfural (HMF) as a starting material. The Sibi group collaborates extensively with the polymer synthesis and polymer degradation team at NDSU.
- 3. Dr. Marisol Berti** – Plant Sciences
Professor, Plant Sciences
North Dakota State University; Fargo, ND
Identify potential industrial crops suitable for North Dakota and the region. Understand the dynamics of crop rotation and value of these industrial crops and conduct the Life Cycle Assessment for the agricultural phase of the industrial crops.
- 4. Dr. Mikhail Bobylev** – Polyformamides
Professor, Chemistry
Minot State University; Minot, ND
The main goal of Bobylev's research is to develop novel sustainable materials based on a novel type of polymers – substituted polyformamides. This goal will be achieved by the development of a new method of polymerization based on his recently patented method for the synthesis of substituted formamides.
- 5. Dr. Qianli (Rick) Chu** – Organic Materials
Associate Professor, Chemistry
University of North Dakota; Grand Forks, ND
The main focus of Dr. Chu's research for the Center for Sustainable Materials Science (CSMS) is the construction of innovative organic materials, such as chiral/stereoregular organic materials and SLIM (strong and lightweight materials). These materials have a variety of applications in nanoscience and sustainable technology. This research also offers new opportunities for molecular level structure-property studies. Dr. Chu's group is best known for their work on solid-state photopolymerization and supramolecular atropisomer. (For details, please visit the Chu group website: <http://www.und.edu/dept/chu/>)
- 6. Dr. Guodong Du** – Catalysis and Green Chemistry

Associate Professor, Chemistry
University of North Dakota; Grand Forks, ND

Dr. Du's research for the Center for Sustainable Materials Science (CSMS) centers on catalysis and green chemistry. Currently, one of the main focuses is the development of efficient and selective catalytic systems for the synthesis of biodegradable polymers such as polycarbonates, polylactides, and polyesters, from renewable resources such as carbon dioxide and biomass.

7. **Dr. Khwaja Hossain** – Industrial uses of wheat bran
Professor, Biology
Mayville State University; Mayville, ND
Dr. Hossain is a Bangladesh native who came to NDSU in 2000 to work on Wheat Genomics and is now a Professor of Biology at Mayville State University. He has been involved in various aspects of genetics and genomics research in uptake and translocation health related micronutrients in crop plants with continuous funding support from ND-INBRE. Dr. Hossain's focus with the Center for Sustainable Materials Science (CSMS) is utilizing wheat bran as filler in synthesizing industrial products. Eleven percent of wheat grain is bran, 90% of the bran is disposed of as waste which poses an environmental threat. Successful completion of Dr. Hossain's research work will help find alternative uses of wheat, increasing wheat growers' profit as well as reducing environmental pollution.
8. **Dr. Alena Kubatova** – Comprehensive chemical characterization of lignin degradation products
Professor, Analytical Chemistry
University of North Dakota; Grand Forks, ND
Within the Center for Sustainable Materials Science (CSMS) research, the Kubatova's research team will focus on development of new analytical methods for products from valorization of lignins. In our study, we pursue a comprehensive characterization starting with the initial feedstock, serving as a reference point, followed by that of its breakdown products. The analytical strategies include: 1) mass balance closure using a newly developed thermal carbon analysis (TCA) protocol, 2) MW determination using gel permeation chromatography with mass spectrometry (GPC-MS) and 3) evaluation of main structural features through phosphorylation followed by nuclear magnetic resonance (³¹P NMR) spectroscopy.
9. **Dr. Mafany Ndiva Mongoh** – Biodegradable Polymers
Ag/Science Faculty
Sitting Bull College; Fort Yates, ND
Dr. Mongoh's research interests focus on the impact of microorganisms in the environment, with an emphasis on the ecological roles microbial communities play in habitat interactions and processes. As a member of the Center for Sustainable Materials Science (CSMS) research group, he studies the natural fate of materials at the end of the sustainability cycle. He is conducting research on the ability of novel polymers to biodegrade so that these polymers meet the requirements of truly sustainable materials. His contribution to the CSMS research group will be demonstrating and harnessing the natural potential of microbes to degrade, transform and safely remove these polymers from the waste stream.
10. **Dr. Alexander Parent** – Sustainable Polymer Building Blocks
Assistant Professor, Chemistry

North Dakota State University; Fargo, ND

In the Center for Sustainable Materials Science (CSMS), Parent's group is researching green and sustainable routes to polymer building blocks. Areas of particular focus are the development of catalyst systems using earth abundant metals and chemical processes using benign solvents and reagents, such as water and air. By improving the methods used for generating polymer building blocks the polymers themselves can be made more cheaply and sustainably.

11. **Dr. Michael Parker** – 3D Printing

Michael Parker

Instructor, Pre-Engineering/Math

Cankdeska Cikana Community College, Fort Tottel, ND

Focus: 3D printing

12. **Dr. Ghasideh Pourhashem** – Life Cycle Assessment

Assistant Professor, Coatings and Polymeric Materials

North Dakota State University; Fargo, ND

Provides expertise in Life Cycle Assessment

13. **Dr. Mohiuddin Quadir** – Value-added biomedical polymers and materials from renewable sources

Assistant Professor, Coatings and Polymeric Materials

North Dakota State University; Fargo, ND

Mohiuddin Quadir's research group aims at designing value-added biomedical polymers and materials from renewable sources. The cohort of macromolecules and assemblies synthesized from Quadir's laboratory includes nanotechnology-powered delivery platforms, bioactive hydrogels and synthetic implants. In parallel to the mission statement of the Center for Sustainable Materials Science, we will be using building blocks derived from biomass to generate sustainable analogues comparable in efficacy to current state-of-the-art pharmaceutical polymers and devices.

14. **Dr. Bakhtiyor Rasulev** – Computational Chemistry and Cheminformatics in Research and Design of Polymeric Materials

Assistant Professor, Coatings and Polymeric Materials

North Dakota State University; Fargo, ND

Within the Center for Sustainable Materials Science (CSMS) research, the research in the Rasulev group is focused on development of predictive models to design novel bio-based polymeric materials and to predict various properties, including degradation rate, solubility, toxicity, etc. The group applies computational chemistry and cheminformatics methods for modeling, data analysis and development of predictive structure-property relationship models to find structural factors responsible for activity of investigated polymeric materials. The group is planning to develop a materials database, which will be useful in designing new polymeric materials and nanomaterials, as well as assist in prediction of various properties, including degradation pathways for life cycle assessment.

15. **Dr. Chad Ulven** – Biocomposites

Professor, Mechanical Engineering

North Dakota State University; Fargo, ND

The biocomposite group within the Mechanical Engineering Department at North Dakota State University (NDSU) has been involved in multiple research projects within the Center for Sustainable Materials Science (CSMS). This research group led by Dr. Chad

A. Ulven currently consists of six graduate and undergraduate students working on bio-based composite development, environmentally friendly composites, characterization and modeling of bio-based composites and improving thermo-mechanical properties of bio-composites. The research mainly involves the development of novel bio-based composites using flax fiber and bio-based thermoset resins such as epoxidized sucrose soyate (ESS) or methoxylated sucrose soyate polyols (MSSP). Studies conducted by this research group have proven that bio-based composites using ESS or MSSP exhibit superior mechanical properties compared to other natural fiber reinforced composites using other bio-based or petroleum-based resins. In addition, to further improve the fiber-matrix adhesion and other mechanical properties, the effect of different mechanical processes and chemical surface treatments of natural fibers are being examined. Investigating time-dependent properties of newly developed composites is another important aspect of the research projects being conducted by the biocomposite group. Fatigue and creep testing along with the development of fatigue damage and creep models applicable to these bio-based composites help gain a thorough understanding of their potential expansion into more engineering and structural applications.

16. **Dr. Brent Voels** – 3D Printing

Instructor, Science

Cankdeska Cikana Community College, Fort Totten, ND

Focus: 3D printing

17. **Dr. Andriy Voronov** – Plant Oil-Based Vinyl Monomers and Polymers Thereof

Associate Professor, Coatings and Polymeric Materials

North Dakota State University; Fargo, ND

The main goal of this project is to determine the feasibility of using oil from different oil-seed crops for synthesis of high value and high profit bio-based specialty monomers for free radical polymerization. If successful, new library of plant oil-based monomers will be applied directly in copolymerization with conventional vinyl counterparts to develop high-performance biobased polymer materials (including latexes, emulsions) for coatings/paints/adhesives applications.