1. **Dr. Dean Webster** – High Performance Bio-based Thermosets
   Professor and Chair, Department of Coatings and Polymeric Materials
   North Dakota State University; Fargo, ND
   Within the Center for Sustainable Materials Science (CSMS), 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, Department of 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 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, Department of Plant Sciences
   North Dakota State University; Fargo, ND
   Dr. Berti's Center for Sustainable Materials Science (CSMS) research focus is to: (1) identify potential industrial crops, and their potential as a biomass feedstock for the synthesis of monomers, suitable for North Dakota and the region; (2) understand the dynamics of crop rotation and value of these industrial crops; and, (3) conduct the Life Cycle Assessment for the agricultural phase of the industrial crops.
4. **Dr. Mikhail Bobylev** – Polyformamides
   Professor of Chemistry, Division of Science
   Minot State University; Minot, ND
   The main goal of Bobylev's Center for Sustainable Materials Science (CSMS) research group 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, Department of 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 work on solid-state photopolymerization and supramolecular atropisomer.

6. **Dr. Guodong Du** – Catalysis and Green Chemistry
   Associate Professor, Department of Chemistry
   University of North Dakota; Grand Forks, ND
   Within the Center for Sustainable Materials Science (CSMS), Dr. Du's research 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 of Biology, Division of Science and Mathematics
   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 research 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 Kubátová** – Comprehensive Chemical Characterization of Lignin Degradation Products
   Professor of Analytical Chemistry, Department of Chemistry
   University of North Dakota; Grand Forks, ND
   Within the Center for Sustainable Materials Science (CSMS) research, Kubátová's research team will focus on the development of new analytical methods for products from the 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) molecular weight (MW) determination using gel permeation chromatography with mass spectrometry (GPC-MS); and, (3) evaluation of main structural features through phosphitylation followed by nuclear magnetic resonance (^{31}P NMR) spectroscopy.
9. **Dr. Mafany Ndiva Mongoh** – Biodegradable Polymers
   Instructor in Ag/Science
   Sitting Bull College; Fort Yates, ND
   Dr. Ndiva 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. **Alexander Parent** – Sustainable Polymer Building Blocks
    Assistant Professor of Chemistry, Department of Chemistry and Biochemistry
    North Dakota State University; Fargo, ND
    Research Description: 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
    Instructor of Pre-Engineering/Math
    Cankdeska Cikana Community College; Fort Totten, ND
    Dr. Parker, along with Dr. Brent Voels, switched from Center for Regional Climate Studies (CRCS) to Center for Sustainable Materials Science (CSMS) in Year 5 and has initiated work on 3-D printing for various applications with the goal of printing biopolymers. Drs. Parker and Voels look to move into a collaborative effort with materials researchers for the formation and optimization of different biopolymers.
12. **Dr. Ghasidesh Pourhashem** – Life Cycle Assessment
    Assistant Professor, Department of Coatings and Polymeric Materials
    North Dakota State University; Fargo, ND
    Dr. Pourhashem's Center for Sustainable Materials Science (CSMS) research focus is to assess the life cycle cost and environmental impacts of lignin byproduct valorization of lignocellulosic ethanol biorefineries. Due to the complexity and non-uniformity of lignin structure and a lack of commercialized pathways for converting it to higher value products, many current lignocellulosic biorefinery designs assume using the lignin-rich byproduct for its energy content to meet the facility's heat and power needs. Using lignin for generating higher value products, however, not only can boost the economic viability of a biorefinery, but it may also improve the system's environmental performance. Pourhashem has identified two lignin byproduct valorization pathways for feasibility and commercial cost-benefit analysis including using lignin (1) as a filler to improve selected properties of epoxy matrix in thermoset composites [in collaboration with D. Bajwa, NDSU], and (2) as a replacement for the phenol portion of phenol formaldehyde (PF) resin [in collaboration with Michigan State University].
13. **Dr. Mohiuddin Quadir** – Value-added Biomedical Polymers and Materials from Renewable Sources
    Assistant Professor, Department of Coatings and Polymeric Materials
    North Dakota State University; Fargo, ND
    Dr. Quadir's Center for Sustainable Materials Science (CSMS) research group aims at designing value-added biomedical polymers and materials from renewable sources. The cohort of macromolecules and assemblies synthesized in Quadir's laboratory includes nanotechnology-powered delivery platforms, bioactive hydrogels, and synthetic implants. In parallel to the mission statement of CSMS, Quadir's group 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, Department of Coatings and Polymeric Materials
    North Dakota State University; Fargo, ND
    Within the Center for Sustainable Materials Science (CSMS), the research in the Rasulev group is focused on the 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, Department of 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). Dr. Ulven's CSMS group works 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** – 3-D Printing
    Instructor of Science
    Cankdeska Cikana Community College; Fort Totten, ND
    Dr. Voels, along with Dr. Michael Parker, switched from Center for Regional Climate Studies (CRCS) to Center for Sustainable Materials Science (CSMS) in Year 5 and has initiated work on 3-D printing for various applications with the goal of printing biopolymers. Drs. Voels and Parker look to move into a collaborative effort with materials researchers for the formation and optimization of different biopolymers.
17. **Dr. Andriy Voronov** – Plant Oil-Based Vinyl Monomers and Polymers Thereof
    Associate Professor, Department of Coatings and Polymeric Materials
    North Dakota State University; Fargo, ND
    The main goal of Dr. Voronov's Center for Sustainable Materials Science (CSMS) research group 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 bio-based polymer materials (including latexes and emulsions) for coatings/paints/adhesives applications.