



Company Information

Company Name	<i>Polymers Center</i>	Date Submitted	<i>April 27, 2026</i>
Project Title	<i>Design and Build of a Polymer Grinding Station _ Phase 2 (PCE_GRIND2)</i>	Planned Starting Semester	<i>Fall 2026</i>

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the table below. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	1
Computer	1	Systems	0-1

Company and Project Overview:

The Polymer Center was founded in 1972 when the State of North Carolina funded plastics specialists in the Industrial Extension Service program at UNC Charlotte. The center, located at that time on the UNC Charlotte campus, expanded in 1994 when a joint venture was entered into with NCSU to form the PEP (Polymers Extension Program). By 1999, PEP moved off the UNC Charlotte campus (to the close by University Research Park) and became today's Polymers Center of Excellence (PCE). In 2012, Polymers Technology Center (PTC) was added for small scale production for plastic injection molding and compounding plastics. Since then, the Polymers Center has continued to impact economic development through education, research and development, and trial production. In addition to their work promoting advances in the Polymer industry and job growth for North Carolina, The Polymer center contributes towards the development of the next generation of engineering talent through sponsorship of Senior Design projects and the funding of the Joe Bennett scholarship. This scholarship pays the full tuition for the last two years of a deserving student's engineering education at UNC Charlotte. This project will continue the development of a piece of test sample preparation equipment for the PCE testing laboratory.



Project Requirements:

The Polymer Center helps big and small companies develop new types of polymers. In collaboration with our subsidiary, the Polymers Technology Center, we can offer high-quality compounding and extrusion services to develop materials. We assist businesses with their production requirements, from creating trial samples with our adaptable lab scale 18mm and 21mm twin screw extruders. Some of the newer innovations incorporate sustainable materials that can clump and prevent processing until it is made into a more uniform state.

The purpose of the Phase 1 project (Fall 2025 – May 2026) was to develop a benchtop grinding station where small quantities (5-20lb) of pelletized material can be ground to a uniform state prior to further processing. This is the apparatus that resulted from Phase 1:





The objective for the Phase 2 project will be to design and implement improvements in the capabilities of the machine. One capability will be to increase the processing capacity of the machine. Current capability is 3 lbs./hour, and the goal will be to increase that to 20 lbs./hr. One issue the current system has is overheating during the grinding process. When this happens, the material starts to gum up and plug. To deal with this, another objective is to add cryogenic cooling to the machine to prevent the heat build-up. Heat transfer analysis will need to be conducted to understand the current performance and design a sufficient cooling capacity. The cooling may involve both chilling of the material prior to processing and cooling of the actual grinding process. Different material compositions will need to be accommodated in the design.

The student team will also interview the industry supporter to determine what other improvements are desired based on their usage after delivery by the Phase 1 team.

Expected Deliverables/Results:

- Increase processing capability from 3 lb./hour to 20 lbs./hr.
- Design and add a cryogenic cooling system to prevent grinding overheating
- Define other design enhancements based on PCE usage of the Phase 1 machine. Capture this in the new SOW/Specification.
- Modifications to the machines' hardware and software to implement the design enhancements.
- User manual and Maintenance manual

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Interest in Machine Design and Control
- Interest in precision manufacturing