Primet Precision Materials is a company that focuses on the design and production of nano-sized powders for energy storage applications. It is a small startup company with approximately 30 employees, who are mostly a mix of engineers and technicians. The company's atmosphere is very laid-back and friendly – there is no rigid corporate hierarchy, which makes for an efficient, constructive work environment. Everyone at Primet has a different area of expertise, and you are always welcome and encouraged to approach anyone with questions or ideas, including the founder and CTO of the company.

I had a number of responsibilities, including a mix of small, everyday tasks and more involved long-term projects. My biggest project involved analyzing x-ray absorption spectroscopy and x-ray diffraction data. I attended a training conference at the University of Binghamton to learn how to process XAS data, and then worked for several weeks on figuring out the detailed crystal structure of one of our materials throughout the battery charge-discharge cycle. Additionally, I registered as a user for two of the national synchrotron sources, completed all the required safety training, and submitted a proposal for beam time so that I can help carry out another XAS/XRD experiment during my next co-op term. I also helped with starting a collaborative project with a computational materials science research group at Cornell, which will hopefully continue next summer, and possibly result in a joint publication.

Another of my major responsibilities was working with our computer database system, which tracks all of Primet's materials in every stage of production. The database system is fairly new and is undergoing constant changes and improvements. I worked on inputting old records into the database and researching and reconciling inconsistencies between existing records. Additionally, I looked up information stored in the database and compiled spreadsheets to look for trends between the characteristics of our materials at different stages of the production process.

Finally, I worked on a number of routine characterization and production processes, including Carbon analysis, particle size distributions, tap density, compression index, optical microscopy, electrode compressed density tests, viscosity measurements, and spray drying. I also designed a new characterization test – the powder flowability index. I designed the apparatus based on a more expensive commercial model, and came up with a simple, consistent procedure that any technician can
carry out. For several characterization tests and procedures, I wrote standard operating procedures so that the testing is as consistent as possible when carried out by different people, and so that other employees will have a set of instructions for reference after I leave.

My AEP courses at Cornell did not directly relate to any of my projects at work, but the materials science classes that I took as electives were extremely applicable to my crystallography work. In general, I feel that my coursework has taught me the core problem-solving skills and work ethic necessary to succeed in most engineering settings, and I felt well prepared to approach all the assignments given to me, even if I was unfamiliar with the technical details.

My living situation was not typical for co-op students, since Primet is located in Ithaca. I lived in the same apartment as during the school year, which was very convenient, since I know that finding housing tends to be very challenging for co-op students. My social life was also essentially the same as during the school year – I was still able to sing in the Cornell University Chorus and live with four of my closest friends. I wasn't used to having so much free time in the evenings, and initially I was a bit bored, but eventually I picked up some new hobbies to occupy my time. For transportation, I drove a car to work. Previous Primet co-op students have been able to ride the bus and/or bike to work, but I was extremely happy to have a car, since some of my work required me to travel back and forth between Primet and the Cornell libraries.

On the whole, working at Primet has been a fun, rewarding, and educational experience. I have had the chance to see how engineers work in both the production and the research and development sides of industry. I learned how to balance several different projects, how to deal with changing priorities and variable circumstances, and how to communicate effectively with a number of people in varying roles. I am excited to return for my second term in the summer, and I would highly recommend a Primet co-op job for any future students.
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I had a number of responsibilities, including a mix of small, everyday tasks and more involved long-term projects. My biggest project involved collecting and analyzing x-ray diffraction data. In early June, I visited the synchrotron at Argonne National Lab in Chicago for a week to carry out a sophisticated, high-energy x-ray diffraction experiment. It was an excellent experience to be able to use such cutting edge equipment and meet some expert accelerator physicists and materials scientists. I spent the better part of the next month analyzing the data and doing Reitveld refinement fitting to determine the detailed atomic structure parameters of our battery materials throughout charge-discharge cycling under different environmental conditions. This information can help us to refine the crystal structure of our battery materials to improve their electrochemical performance and lifetime.

I also worked on solving some advanced physics problems to aid in the design and invention of new production technologies. The details are confidential, but one of the problems involved complicated fluid dynamics and the other involved the electrical and quantum mechanical structure of atoms. The problems were very difficult, and they required extensive literature searches and analytical calculations. I worked directly with the CTO on these problems, and he provided valuable insight and guidance. I wasn’t able to completely solve either problem, but I provided some insights, approximations, and suggestions for further research.

Finally, I worked on a number of routine characterization and production processes, including Carbon analysis, particle size distributions, tap density, compression index, optical microscopy, electrode compressed density tests, viscosity measurements, and spray drying. I did some comparative studies of the materials used in our production processes, and I compiled data from our database to find trends in material properties and production parameters. For several characterization tests and
procedures, I updated standard operating procedures that I wrote last term so that the testing is as consistent as possible when carried out by different people, and so that other employees will have a set of instructions for reference after I leave.

I was able to directly apply a significant amount of my coursework at Cornell to my projects at Primet. The physics problems I worked on for the CTO required knowledge and skills from my AEP courses in classical mechanics, electrodynamics, and quantum mechanics. Additionally, the materials science classes that I took as electives were extremely applicable to my crystallography and synchrotron work. However, most of the work went well beyond the basics from my classes, so I also did frequent literature searches to find the much more specific and specialized information that I needed. In general, I feel that my coursework has taught me the core problem-solving skills and work ethic necessary to succeed in most engineering settings, and I felt well prepared to approach all the assignments given to me, even if I was unfamiliar with the technical details.

My living situation was not typical for co-op students, since Primet is located in Ithaca. I lived in the same apartment as during the school year, which was very convenient, since I know that finding housing tends to be challenging for co-op students. My social life was also similar to during the school year – most of my friends and roommates stayed for the summer, so we were able to spend plenty of time together. I took advantage of the free time on the weekends and evenings by going for long hikes, singing in a community choir, and cooking elaborate meals with friends. For transportation, I drove a car to work. Previous Primet co-op students have been able to ride the bus and/or bike to work, but I was extremely happy to have a car, since some of my work required me to travel back and forth between Primet and the Cornell libraries.

On the whole, working at Primet has been a fun, rewarding, and educational experience. I have had the chance to see how engineers work in both the production and the research and development sides of industry. I learned how to balance several different projects, how to deal with changing priorities and variable circumstances, and how to communicate effectively with a number of people in varying roles. I loved the research and development aspects of my job, and I was grateful for the opportunity to work on challenging, in-depth, thought-provoking projects. I would highly recommend a Primet co-op job for any future students.