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In Situ Friction Analysis between Reinforced Fibers- Synopsis

The American Society for Testing and Materials, currently known as ASTM International, has a testing method to determine the coefficient of friction from yarn to yarn. This method, labeled ASTM D3412-07, has been known to cause inconsistent precision among laboratories' testing. For this reason, ASTM international states on their website that while this testing standard is being used, it is not recommended.

The purpose of this design project is to begin creating a universal testing stage, one that can be used for general applications, in the hopes that more consistent results can be achieved. Current devices all lack a desirable trait. Some testing devices are economical, but lack the small size to carry out these tests in different environments. Other devices are small enough to fit into the testing chamber of a scanning electron microscope (SEM), but are far too expensive for the average testing facility. This project attempts to combine the best of both worlds, offering an inexpensive alternative to current mechanisms that will eventually have the size and components to operate under the vacuum conditions of an SEM.

Enhancements and modifications to the initial testing mechanism include the ability to adjust key variables, including input tension, apex angle, and yarn take-up speed. A servo motor with an attached aluminum arm allows precise control over whether to increase or decrease the tension going into an initial tension gauge. A slot along the center of the top surface allows for a pulley to be moved and tightened with a nut, allowing for different apex angles if so desired. Finally, the inclusion of a motor with a manual speed controller permits precise control over the speed at which the fibers pass through the pulley system.

While there were a multitude of challenges and setbacks along the way, ultimately resulting in a product not at its full potential, the prototype that was created can be considered a step in the right direction. While there is much to focus and improve upon, the ideas and design selections will serve as a blueprint for future iterations of the design, ultimately leading to the ideal goal of creating a small, economical, light-weight, and vacuum-compatible model of the testing stage designed.