Polymer Degradation Predictive Analysis

The following research that has been conducted at Tennessee State University focuses on polymer degradation. Polymers have a distinct importance within various industries whether they are in aerospace, automotive, or industrial. They are used as seals. It is important to note that there are multiple variations of static and dynamic seals. Gaskets, O-rings, Flat seals, Cork seals, Lip seals, Pressure-sensitive seals, and Thread seals, only account for a portion of what is used in industry. Seals work to contain fluids and gases within systems. Without them in place, systems would not run efficiently, nor would they be safe to operate. That is why it's important to know when these polymers will fail within a service lifetime. Routine maintenance often can be overlooked so that is why this research topic is beneficial.

The goal for this project is to create a program based upon equations and testing methodologies to predict the service lifetime of polymer. Software like Mathlab and Python will be implemented to create the prediction for our material of choice. The specific polymer used within this project is Ethylene Propylene Diene Monomer, which is better known as EPDM. Three main techniques that are prevalent in this research are the Isothermal, Isostress method, and stepped method. The Isothermal method predicts long-term creep behavior, by loading a single specimen under a constant load, while increasing temperature in a stepwise manner until failure. You will utilize multiple specimens to receive data on degradation. Isostress loads a single specimen just like the isothermal method, but the stress increased in stepwise manner, and the temperature is held at a constant rate. You would use multiple specimens to receive conclusive data, just like the isothermal method. The stepped method utilizes one specimen. The

principle sums up the past stresses to calculate the strain of the specimen. The time-dependent response will then be given by how the specimen deforms over time. The shift factors used are decided based on the testing method used. Arrhenius, Eyring, or William-Landel-Ferry will serve as shift factors.