Project Definition

Group 7

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##### A brief background on the project

Microscale combustion calorimeter (MCC) is an efficient instrument to evaluate flammability of materials from only milligram sized samples. MCC uses milligram-sized samples to study the pyrolysis of materials under controlled environment (atmosphere/heating rate/temp. range). Through the decomposition of the products, the heat release rate Q(t)(W/g) is calculated based on the oxygen consumption theory as a function of time. Due to the high cost of many standardized flame retardant tests, MCC can provide significant design flexibility for flame retardant material formations and rapid prototyping options. However, the correlations of flame retardant testing results are often inconsistent with specific parameters extracted from MCC data.

##### The overall goal of the project

In this project, we plan to analyze MCC data from 22 different kinds of adhesive materials. In each kind of adhesive materials, there are 2-3 different formulations. The total sample number is 58. Along with the MCC data, the dataset provided also contains information on pass/fail in accordance with FAR25.853 (a) vertical burn flame retardant test standard. The goal of this project is to establish a correlation between MCC data with actual flame retardant testing results. There are five useful parameters that can be extracted from MCC data and used as features of the model, including heat release capacity, total heat release, ignition temp, pyrolysis residue, and fire growth capacity.

##### The general strategy you plan to use to achieve the goal

In order to achieve our goal, we are interested in using a supervised learning model for classification. Our dataset is composed of 22 different adhesives material time series obtained by MCC, with measurements of temperature; N2, O2, and total flow rates; Oxygen %; HRR; and heating rate. Additionally, we have FR data that provide the actual flame resistance performance of the materials. Our first step will be to get more familiar with the measurements and see how we can use them in our model. Several regression models might be tested to best fit the raw data and obtain the features for further prediction. Afterwards, we will experiment with different classification models learned in class and use these with FR result labels to determine materials’ flame resistance properties.

##### Anticipated risks and contingency plans

Our goal is to build a predicting model for the FR test, based on the MCC data we have. It’s possible that we may encounter many problems with the model fitting. However, there are existing software packages that can manually fit the raw data with different basis sets. Even though we don’t have access to the source codes of the software packages, we do have access to the results. That is to say, for the data fitting step, we could get a general idea of the fitting line. Another thing that might be tricky is the classification of the materials, since similar materials may have similar data. Trying out regression might be a solution for this.