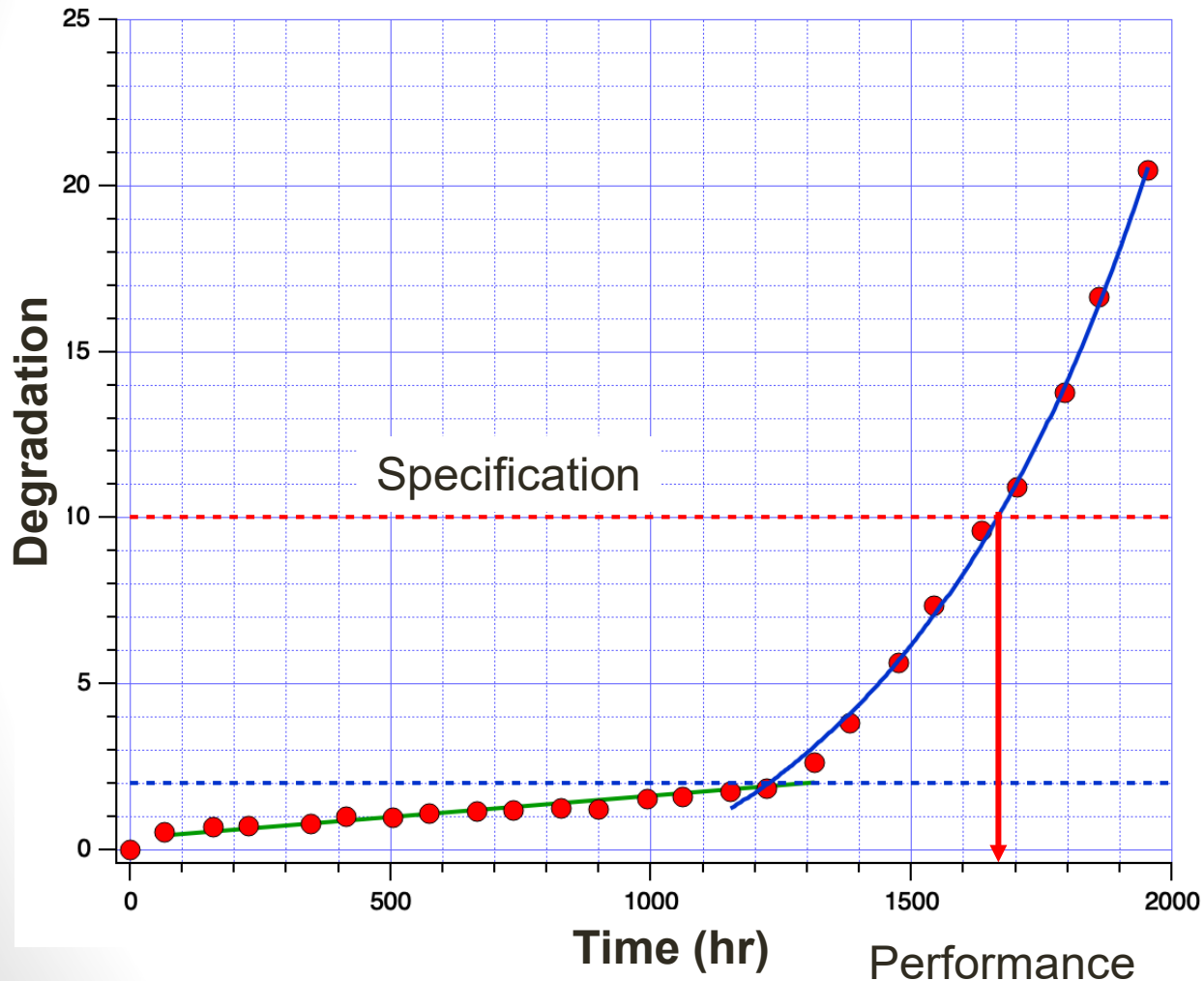


What If Something Needs To Change?

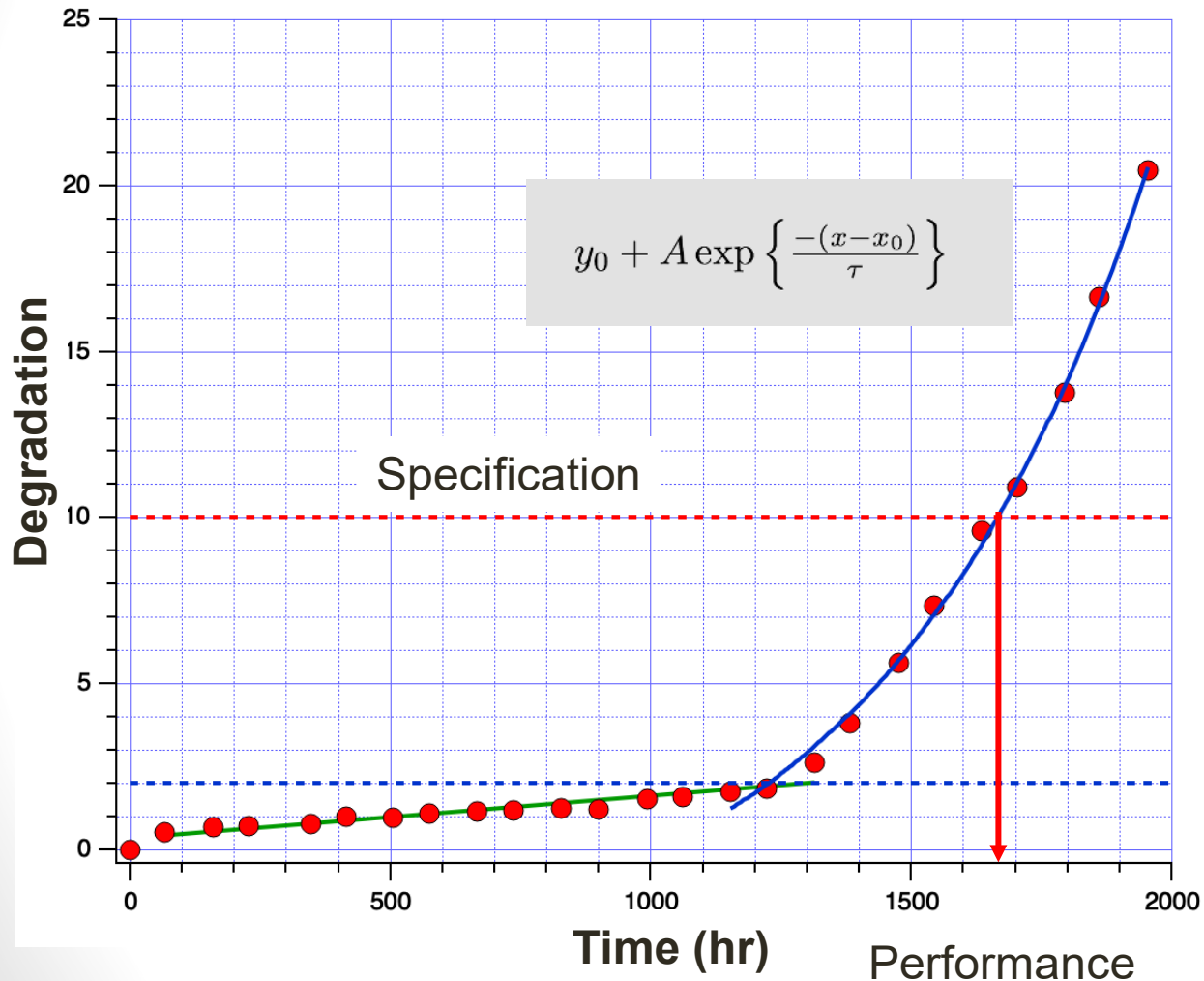


In the course of measuring the performance of your mobile power system, the first decision point encountered: Did it meet specification?

Does the population of samples under test support the robustness needed by the end use application? What is the form of the distribution of data, and does it contain outliers at a high enough level to cause concern?

And if it does not meet specification, what is the course of action? Is this a failure analysis study where the system generally performs to spec, but something has changed and now it does not. Or is this a product development where the trial performance indicates that something in the design and product use must change?

First Course of Action



The first course of action is to fully define the performance and utilize the entire data set to give insight. Instead of relying solely on the singular time to exceed specification as the only metric, quantify the full response in an automated way that can handle the data set of the whole set of samples and the associated statistics in a manner that is robust and not subject to operator interpretation.

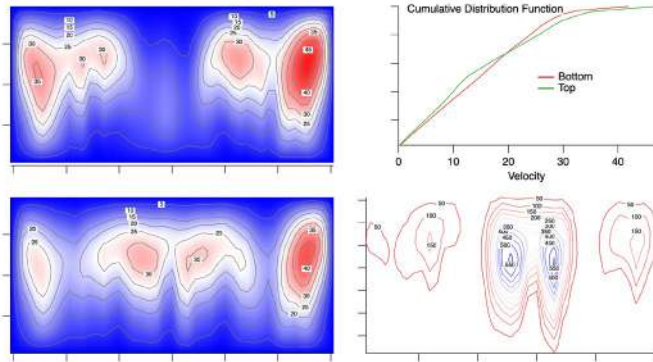
In this example, there appears to be two mechanisms in play, 1) a linear initial phase, 2) followed by an exponential increase. Both regions should be fit and parameterized to allow for further analysis.

Apply Science to Engineering

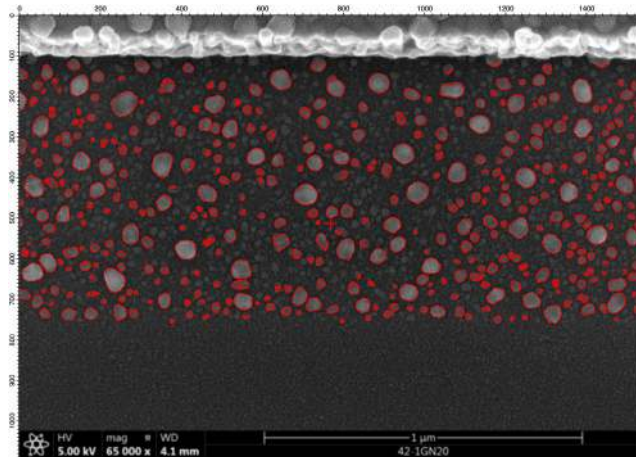
The next course of action is determining which parameters to change, and this is where materials science and data analytics combine to determine what other sets of data are needed to resolve the issue. In materials systems, it is common that no single measurement or metrology technique provides a complete answer.

1) Fishbone or Ishikawa diagrams for failure analysis or, 2) a more general first principles for a product development process can provide a starting point for a working hypothesis. The challenge is selecting the additional tests, and the quantification of those test results, to combine with the existing battery tests. Additional tests could include, but are not limited to, imaging and image quantification, simulations such as computational fluid dynamics (CFD), or material composition and phase analysis such as x-ray diffraction, secondary ion mass spectroscopy (SIMS), and Raman spectroscopy.

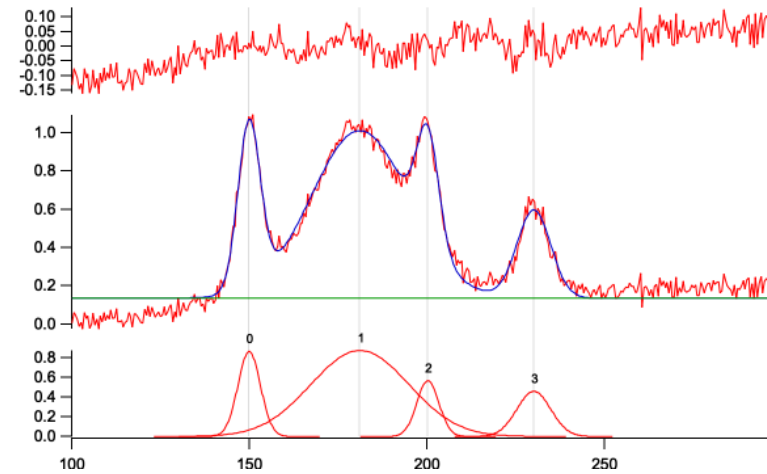
Analytics of Materials Systems



CFD Simulation



SEM with Quantification



Spectral Analysis and Quantification