Prediction of Coating Adhesion using Hyperspectral Imaging

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Electric vehicles are shaping the future of the automotive industry. The traction battery is one of the most important components of electric cars. To ensure that the battery operates safely, it is essential to physically and electrically separate the cells facing each other. Coating a cell with varnish helps achieve this goal. Current studies use a destructive method on a sampling basis, the cross-cut test, to investigate the coating quality. In this paper, we present a fast, nondestructive and inline alternative based on hyperspectral imaging and artificial intelligence. Therefore, battery cells are measured with hyperspectral cameras in the visible and near-infrared (VNIR and NIR) parts of the electromagnetic spectrum before and after cleaning then coated and finally subjected to cross-cut test to estimate coating adhesion. During the cross-cut test, the cell coating is destroyed. This work aims to replace cross-cut tests with hyperspectral imaging (HSI) and machine learning to achieve continuous quality control, protect the environment, and save costs. Therefore, machine learning models (logistic regression, random forest, and support vector machines) are used to predict cross-cut test results based on hyperspectral data. We show that it is possible to predict with an accuracy of ~75% whether problems with coating adhesion will occur. Hyperspectral measurements in the near-infrared part of the spectrum yielded the best results. The results show that the method is suitable for automated quality control and process control in battery cell coating, but still needs to be improved to achieve higher accuracies.