Production Testing of Brake Integrity Including Press Monitoring

SCIEMETRIC POWERTRAIN SOLUTIONS

Challenge

When a reputable brake pad manufacturer shipped defective brake pads to their customers they realized that their quality testing methods needed to change. This problem was resulting in deteriorating customer satisfaction and increasing warranty, quarantine and charge-back costs. Traditionally testing of brake pads for conformance to specification had been done by random sampling destructive testing and/or ultrasonic testing. Sample destructive testing is very expensive and not 100% effective in controlling non-batch related defects. Ultrasonic testing was extremely slow, requiring much configuration and calibration, leading to unreliable results due to process variability in the mass of each brake pad. The manufacturer required a solution that would be able to test 100% of brake pad production to catch all defects while having the ability to create reports demonstrating to their customers that each pad met their specification.

Solution

It is critical that all stages of the brake pad manufacturing process be carried out according to exact specifications in order to ensure they meet strict safety performance guidelines. Sciemetric addressed the challenge by developing a brake pad integrity test system. The system monitors the press quality in the early stages of manufacturing the brake pads, measures the sound and/or vibration and stores all of the data and signatures in a central location for complete traceability and defect analysis from beginning to end.

Brake Pad Pressing

In the beginning of the brake pad manufacturing process the quality of pressing is closely monitored. When brake pads are being created, a powdered dust containing various compounds and binding agents is placed into the mold trays; several trays are then stacked at on top of one another

PRODUCTION TESTING OF BRAKE INTEGRITY INCLUDING PRESS MONITORING KEY FEATURES

- **Ensure all brake pads conform to customer specifications and government regulations**
- **Uses signature analysis for most accurate verification**
- **Reduces manufacturing costs by finding defects such as noise and vibration, press and mis-adjustments during production where repairs are less complex and less costly**
- **Complete traceability: data, including signatures are automatically stored in a central database and cross referenced by serial number(s)**

the science of quality

while a large hydraulic ram is used to press the powder into the mold at extreme pressure and temperature for 30 seconds upon which the ram is withdrawn for ten seconds. This cycle is repeated for several minutes. In this case the Sciemetric system monitors up to six rams, which can be performing at different times collecting pressure and temperature data from each – every few seconds. The system then verifies that each station passes through the prescribed data from each cycle while storing all cycle data on file for future analysis.

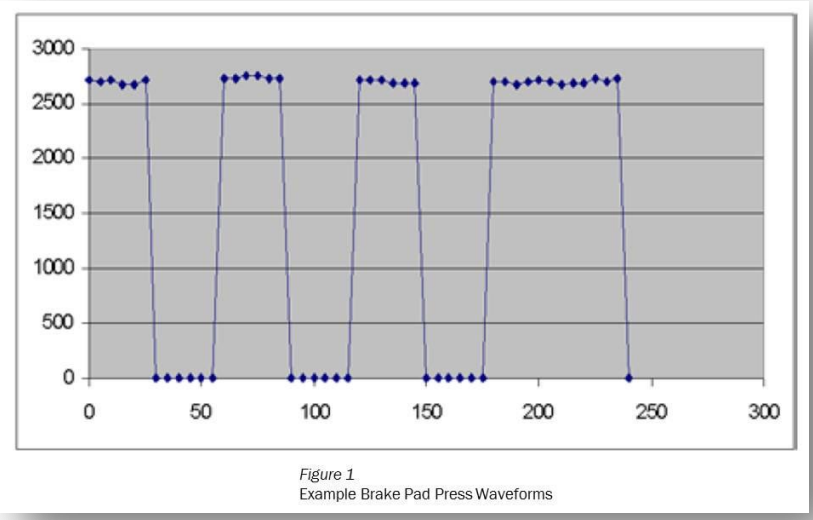

Figure 1
Example Brake Pad Press Waveforms

Sound and Vibration

The system measures the sound and vibration signatures caused by a striker device imparting energy into each brake pad during a measurement cycle. The sound and or vibration data is analyzed in both time and frequency domains to ensure the brake pads with quality issues are identified. Specifically, mathematical manipulation of the time domain sound signature identifies pads with de-lamination and the frequency domain identifies stiffness associated with faults through changes at resonant frequencies, such as bond failure. A simple PASS/ FAIL classification is then made by comparing the signatures of known good brake pads to known defective brake pads

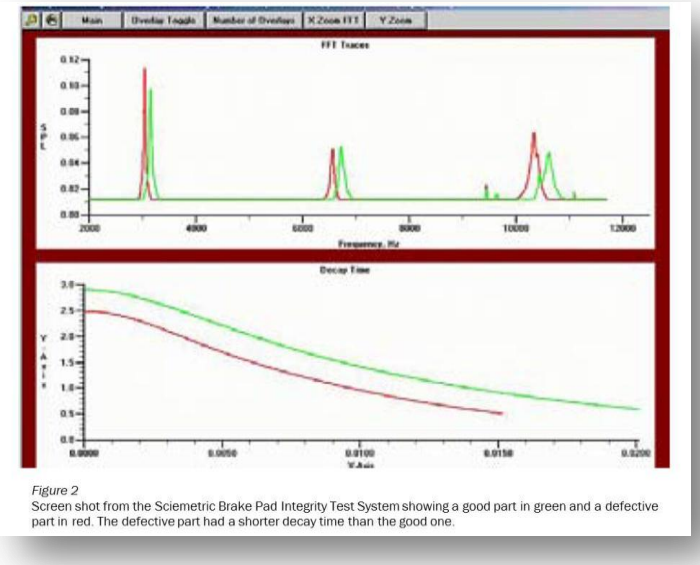

Figure 2
Screen shot from the Sciemetric Brake Pad Integrity Test System showing a good part in green and a defective part in red. The defective part had a shorter decay time than the good one.

Each brake pad will respond to the striker device in proportion to its mass, dynamic stiffness and damping. The effects of defects on these parameters are then analyzed to determine brake pad integrity and automatically generate a pass or fail result. For example, a shift in the first peak frequency can be associated with the stiffness of a metal part or with a rigid body mode. The damping of these peaks can be assessed and associated with bond failures, lamination or cracks in the metal parts.

Request more information: www.sciemetric.com
inquiries@sciemetric.com
1-877-931-9200

sciemetric

Unlike the other forms of testing such as the ultrasonic and random sampling destructive testing the Sciemetric brake pad test solution is immune to variations in the mass of each brake pad. The system automatically provides a pass or fail signal result to an external control system (PLC), which directs the defective brake pads to a quarantine area for further analysis and investigation, while the brake pads that pass the test are sent for shipping.

The data from each test system is stored in a central database where a record of all brake pad line test information is maintained. Only the Sciemetric system enables storage of the data contained in the process signatures. This information can be used to easily generate yield and trend reports with full drill down to the individual part level using simple Windows®-based tools. It can also be used for quick identification on the root cause of issues affecting quality. The data provides valuable insight and visibility required to enact change to improve yield.

Results

By implementing Sciemetric technology the manufacturer has a cost-effective way to test and guarantee quality for every brake pad. Leveraging the full traceability capability allows the manufacturer to proactively prove adherence to specification and regulations, reduce the size of any potential recall and minimize warranty costs.

The manufacturer recovered their initial investment costs within a four-month period and now, years after the installation there have been no defective brake pads discovered by their customers.

Request more information: www.sciemetric.com
inquiries@sciemetric.com
1-877-931-9200

sciemetric