Production Testing of Brake Pad Integrity

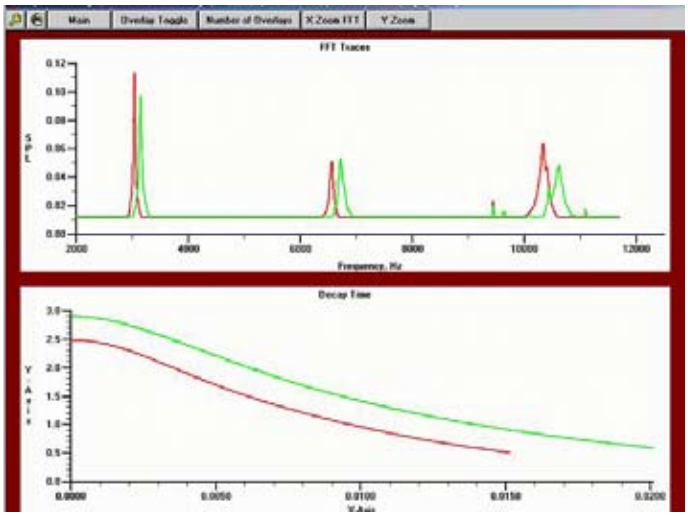
Overview:
Testing of brake pads for conformance to specification has traditionally been done by random sampling destructive testing or ultrasonic testing. Random sample testing is expensive and not very effective in controlling non-batch related defects. Ultrasonic testing is slow, requires significant configuration and calibration, and results are unreliable due to process variability.

The Sciemetric Brake Pad Integrity Test System™ can be used to reliably and efficiently test 100% of brake pad production.

The Sciemetric Brake Pad Integrity Test System™ detects brake pad defects such as;
- Splits and cracks
- Poor cure
- Defective bonding between friction material and back plate
- Friction material de-lamination
- Incorrect friction material modulus

Benefits:
- Improve quality of shipped brake pads
- Reduce warranty claims and charge-backs
- Ensure that each and every brake pad conforms to customer specifications and government regulations
- Increase customer satisfaction

Figure 1
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.



Challenge
A major brake pad manufacturer was shipping defective brake pads to their customers, resulting in deteriorating customer satisfaction and increasing warranty, quarantine and charge-back costs.

Solution
The Sciemetric Brake Pad Integrity Test System™ measures the sound or vibration signature caused by a striker device imparting energy into each brake pad during a measurement cycle. The sound data is analyzed in both time and frequency domains to ensure brake pads with quality issues are identified. In particular, mathematical manipulation of the time domain sound signature identifies pads with de-lamination and the frequency domain identifies stiffness associated faults through changes at resonant frequencies, such as bond failure. Pass or fail classification is made by comparing the signatures of known good brake pads to known defective brake pads.

Each brake pad will respond to the striker device in proportion to its mass, dynamic stiffness and damping. The effects of defects upon these parameters are 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.

Unlike other forms of testing such as ultrasonic, the Sciemetric Brake Pad Integrity Test System™ is immune to variations in the mass of each brake pad. The Sciemetric Brake Pad Integrity Test System™ supplies a pass or fail signal to an external control system (PLC) which directs defective brake pads to a quarantine area for further investigation, while brake pads that pass the test are sent to packing.

Achievement
The Sciemetric Brake Pad Integrity Test System™ is fast, accurate and provides the brake pad manufacturer with the ability to test every brake pad, rather than one per batch random sample testing. The customer recovered initial investment costs within a 4 month period and almost two years after installation there has been no (0%) defective pads discovered by their customers.

The brake pad manufacturer also has plans to deploy Sciemetric's QualityWorX® birth history and traceability software. QualityWorX® will allow the brake pad manufacturer to minimize the cost and risk involved with potential warranty claims. Full traceability will allow the manufacturer to demonstrate adherence to customer specifications while providing the data mining capability required to locate brake pads with specific test result features. Leveraging this capability, the manufacturer can proactively reduce the size of any potential recall and minimize their warranty costs.

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