Trident™ Application Highlight: Testing the Thermal Conductivity of Ceramic Brake Pads using TPS

This Application Highlight addresses the measurement of Ceramic Brake Pads using the FLEX Transient Plane Source (TPS) and Single-Sided TPS Utility

Thermal characterization of brake pads is critical for performance validation and quality control in automotive applications. Thermal conductivity measures a material's ability to conduct heat, while thermal diffusivity is the rate at which thermal energy spreads through a material. Both thermal properties are indicators of thermal management within a braking system that affect brake efficiency, thermal stress concentrations, and rotor/brake pad wear. They also play a role in material performance during development and serve as a quality control parameter in production. Understanding thermal properties helps manufacturers develop products that meet performance standards while extending their lifespans. Herein, we present the results of the thermal conductivity assessment of ceramic brake pads using the FLEX Transient Plane Source (TPS) and Single-Sided TPS Utility.

Figure 1. Brembo P11025N Prime Ceramic Brake Pad.

Standard TPS testing requires two samples (placed on either side of the TPS sensor), whereas the Single-Sided Utility allows testing with only one sample by using an insulating backing material on the side opposite the sample. Both approaches were used to assess the thermal conductivity of Brembo P11025N Prime Ceramic Brake Pads. All testing was performed at room temperature.

The results indicated that the thermal conductivity of the Brembo Prime Ceramic Brake Pads was 1.41 W/mK using the standard TPS configuration, with the single-sided results agreeing within 2%. No thermal conductivity specification was available for the sample but is expected to be > 1 W/mK based on the nature of the material.

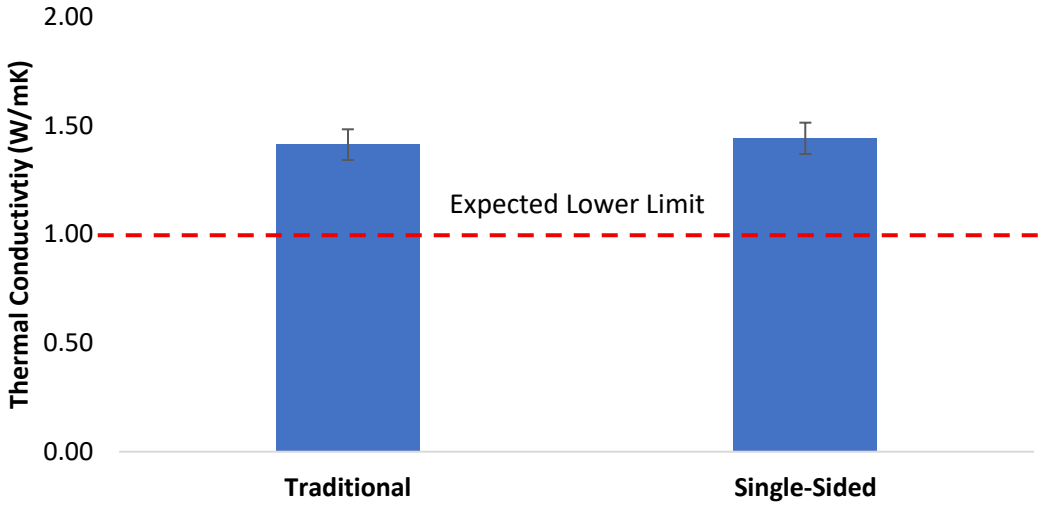

Figure 2. Thermal Conductivity Results of Ceramic Brake Pads Using the Traditional TPS and Single-Sided Utility.

While results show good agreement, the single-sided setup possesses inherent limitations compared to the traditional double-sided configuration. The TPS Single-Sided Utility offers an accuracy of +/- 10% and is limited to samples with thermal conductivity > 1 W/mK. Per the ISO 22007-7 standard, single-sided measurements should be reserved exclusively for scenarios where a double-sided setup is unfeasible[1].

About Us:

C-Therm is the world leader in thermal conductivity instrumentation for test and measurement of polymers, ceramics, composites, insulation, textiles, and a wide range of other materials. Headquartered in Fredericton, New Brunswick, Canada, C-Therm specializes in non-destructive thermal analysis solutions that empower researchers, manufacturers, and quality control professionals across various industries – from aerospace and automotive to electronics and energy storage.

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[1] ISO 22007-7 www.iso.org