Technology Opportunity
Glenn Research Center • Cleveland • Ohio
Technology Transfer & Partnership Office

TOP3–00188

Temperature Probe for Measuring up to 2400 °C

Technology

This technology is for a probe that uses multiwavelength to measure very high temperatures, from 1380 °C up to 2400 °C.

Benefits

This high-temperature probe offers many advantages over thermocouple-based designs

- It can operate in higher temperatures
- It can operate in an oxidizing environment; thermocouples that operate at these temperatures require an inert environment
- It can have a longer useful life than thermocouples
- It is not affected by electromagnetic interference

Commercial Applications

This probe can replace thermocouples in high-temperature applications such as

- Inside gas turbine engines
- Inside industrial vacuum furnaces
- Inside industrial gas-fired furnaces

Technology Description

Researchers at the NASA Glenn Research Center have developed a new type of temperature probe, which is capable of measuring temperatures beyond the range of conventional thermocouples, up to 2400 °C (4350 °F). The probe consists of a high-temperature ceramic sheath inserted into a high-temperature metal support section. For the example shown in figure 1, the ceramic sheath is beryllia (BeO) and the metal support is Inconel, but other high-temperature materials could be used. The active detector of the probe is a fiber optic inside the sheath/support assembly, as depicted in figure 2.

The ceramic portion of the probe is inserted into the hot area of interest, while the metal support and the fiber optic would be in a cooler area. The length of the ceramic sheath and metal support for a specific probe would be designed based on the dimensions of the intended application. Since the inside and outside temperatures of the ceramic sheath are nearly the same, using multiwavelength pyrometry to measure the inside temperature of the sheath in an effective way to capture the temperature of interest. As the ceramic heats up, it emits black body radiation, which is detected by the fiber optic. The fiber-optic signal is transmitted to a spectrometer where the temperature of the ceramic tip is determined.

Figure 1.—High-temperature ceramic sheath inserted into a high-temperature metal support section.

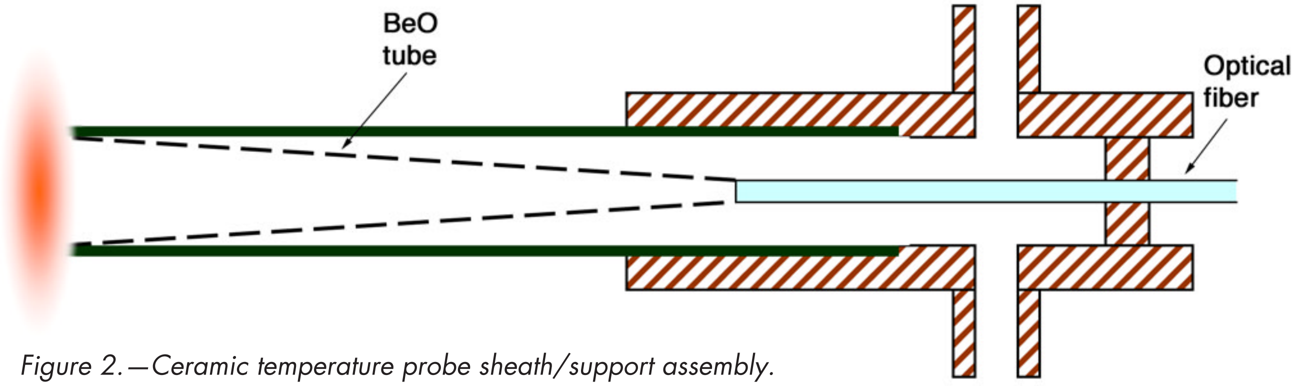

Figure 2.—Ceramic temperature probe sheath/support assembly.

This new probe has many advantages compared to a thermocouple, starting with its ability to withstand higher temperatures and oxidizing environments. The upper limit of the probe is the useful upper limit of the BeO sheath, which is about 2400 °C in oxidizing atmospheres. A thermocouple could only survive under these conditions with an auxiliary cooling system and inert gas protection. This ability to withstand higher temperatures and oxidizing atmospheres translates into extended lifetimes even during operation in less severe conditions. NASA's new probe also has the advantage that it is not affected by electromagnetic interference, which makes it more accurate and easier to use.

Options for Commercialization

The NASA Glenn Research Center is interested in partnering with companies that are able to develop this technology into commercial products. If you are interested in learning more about partnering with NASA, or if you would like to talk with NASA Glenn's high-temperature probe experts, please contact the Technology Transfer & Partnership Office.

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Key Words

Ceramics
Emissivity
Fiber optics
Gas temperature
High temperature
Spectroscopy
Temperature probe