

Multi-function measuring spark plug for optical combustion analysis

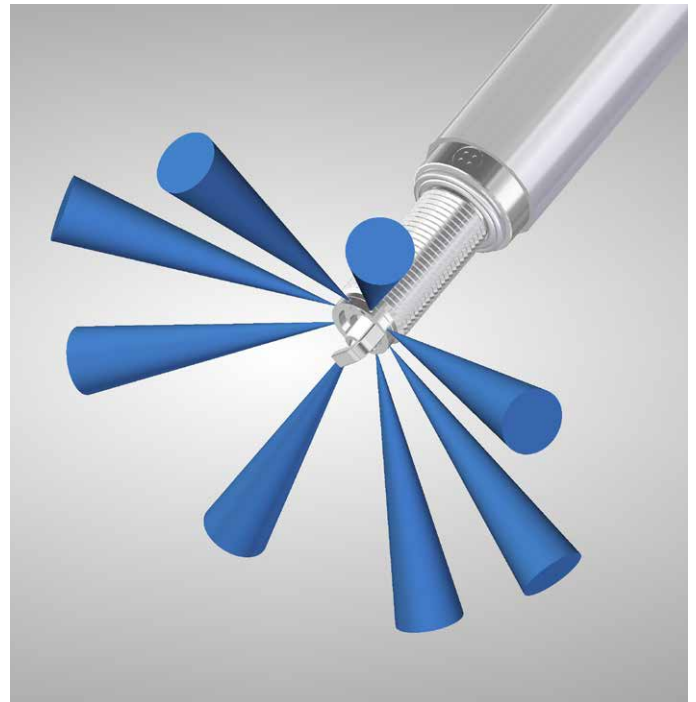
Integrated fiber optics and cylinder pressure sensor

Multi-function measuring spark plugs combine the merits of cylinder pressure measurement with the advantages of optical combustion analysis in a compact and robust product. The continually growing demands on emissions and fuel consumption and the efficiency of combustion engines places ever higher requirements on measurement technology. In order to develop or optimize engine designs, automobile manufacturers and suppliers are instructed to employ measuring systems that supply them with precise data on the combustion process and cylinder pressure.

The integration of pressure transducers in the spark plug has the advantage that no additional bores in the cylinder head are required. To create these bores is very time and cost intensive. In addition to the cylinder pressure, combustion light signals are increasingly being used in engine development. The optical sensors required for this are also housed within the spark plugs. In order to obtain the cylinder pressure in addition to the optical signals, it is then necessary again to create access points for the cylinder pressure sensors in the cylinder head.

With the new multi-function measuring spark plugs, Kistler offers a unique product on the market: the integration of the two measurement technologies (pressure and light) eliminates further need for additional expense on the engine.

Working together for individual success. Kistler is happy to support you with your special requests in the development of an individual solution.



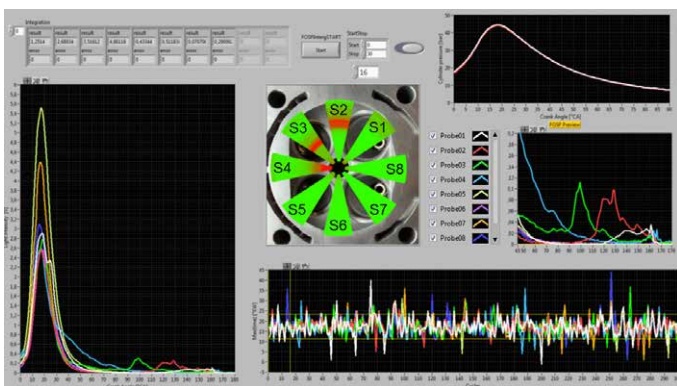
The optical probes can be selected, depending on the customer requirement, at any aperture angle and viewing direction.

Vividly depicting combustion processes

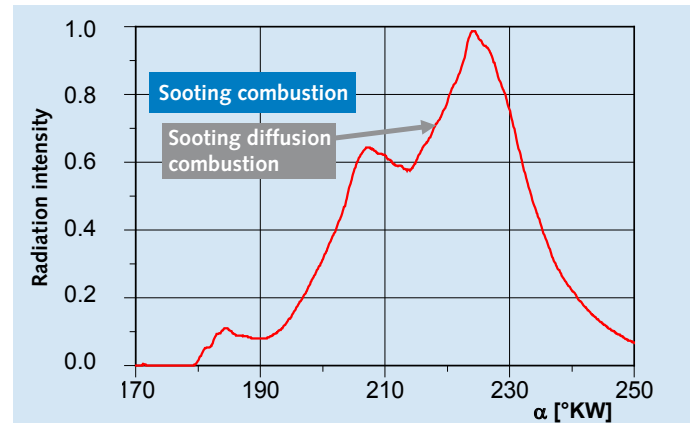
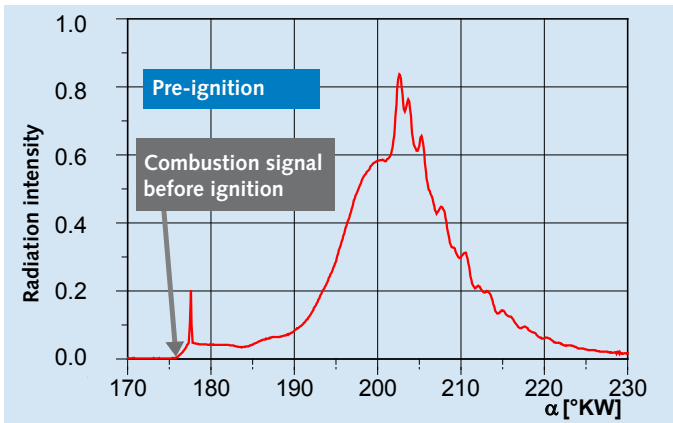
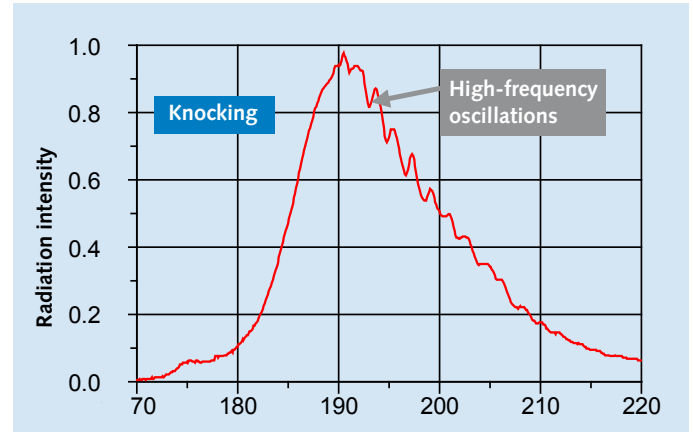
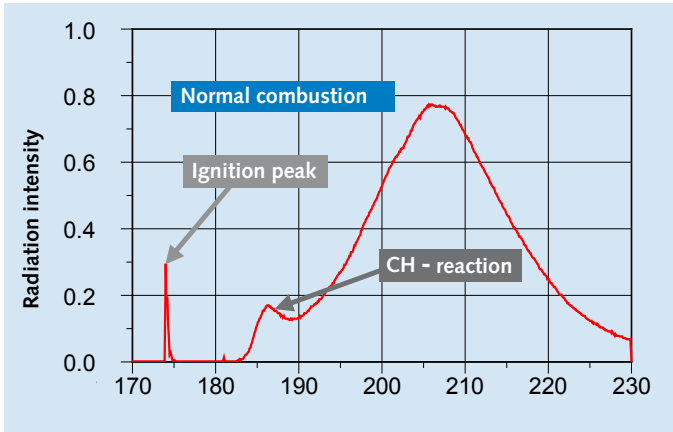
The new multi-function measuring spark plugs, in contrast to conventional measuring spark plugs can be equipped with up to twelve optical probes. They transfer the flame radiation that is produced during combustion in the combustion chamber directly to the combustion analyzer via a light amplifier. By using appropriate triggers, the combustion cycles of interest can be detected and analyzed. The combustion analyzer displays in a vivid graphic whether the combustion processes in the combustion chamber occur according to the defined parameters. For example the location of the knock center or the location of sooting combustion can be detected precisely.

Precisely measuring cylinder pressure

In addition to visualizing the combustion, the new multi-function measuring spark plug also measures the cylinder pressure. What accounts for this is the smallest piezoelectric high-temperature cylinder pressure sensor in the world, which is integrated in the measuring spark plug. The sensor is almost flush-mounted and has a natural frequency of approximately 60 kHz. Consequently, it is suitable for knock application and calibration.



Application of multi-function measuring spark plug in a GDI engine in transient operation: visualisation of soot formation regions within the combustion chamber in real time.



Using the multi-function measuring spark plug, different parameters can be measured in the combustion chamber.

The benefits at a glance

- A compact product for cylinder pressure measurement and optical combustion analysis without expensive separate measuring bore
- Maximum measurement accuracy and precision
- Detection of knocking, pre-ignition and sooting combustion
- Improved engine performance with regard to fuel consumption, mixture formation and exhaust emissions

Technical data

Pressure sensor

| | | |
|--------------------------------------|------|-----------|
| Measuring range | bar | 0 ... 200 |
| Linearity | %FSO | <±0.5 |
| Thermal sensitivity shift 200 ±50 °C | % | <±1 |
| Overload | bar | 250 |

Optical probes

| | | |
|-------------------|-----|---------------|
| Maximum number | | 12 |
| Aperture angle | ° | 7 ... 40 |
| Viewing direction | ° | 70 |
| Thread sizes | | M10, M12, M14 |
| Temperature | °C | 500 |
| Pressure | bar | max. 250 |

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