NDIR gas sensors are used successfully in a wide range for detecting, measuring and controlling infrared active gases. The applications are widely diversified in regard to the gases and the concentration levels to be measured. The advantages of this technology are the high measuring accuracy, the long term and system stability as well as the robustness of these systems based on a tough construction. Mostly the maximum storage and operating temperature of common NDIR gas sensors is limited at around +60 °C and the applications of the sensor at higher temperatures are highly restricted. This fact was the intention to develop a NDIR gas sensor with a distinct extended temperature range up to 200 °C and for harsh environments like high vapour partial pressure up to 800 mbar or solvent atmospheres.

**Advanced Packaging**

Emitter and detector are assembled by special technologies like soldering and welding to ensure the hermetic housing. Especially for optical coated IR-windows and filters a new metallization technology for free shaped geometries was developed (Fig. 1).

The emitter based on thermally stable nano-amorphous diamond-like carbon coatings. This structure enables high membrane temperatures up to 850 °C as well as high radiation intensities. Ongoing developments show further enhancements of the emitter. The emission surface is based on advanced silicon nanostructures. Therefore a spectral broadband emission coefficient nearly 1 is achievable as an ideal blackbody (Fig. 4).

The thermopile detector consists of highly effective BiSb/Sb thermocouples which enables a high sensitivity at high temperatures, too. Two versions of optimized interference layers are used for an enhanced absorption at 3 until 5 µm (short) and 5 until 13 µm (long, Fig. 5).

Based on these advanced IR components (Fig. 1) a high temperature gas measurement module was developed (Fig. 2) to measure concentrations up to 20 Vol-% CO₂. This module consists of a sensor which can resist up to 200 °C. The signal processing unit is mounted in a lower temperature range up to 70 °C outside of the measurement environment. To reduce the temperature influences of the CO₂ measurement it’s essential to use a broadband filter which considered the temperature extension of the gas absorption lines and the center wavelength shift of the filter. Fig. 3 shows the remaining temperature influence of the absorption as a function of the CO₂ concentration. It is shown that the concentration can be determined in the whole temperature range.

The following charts in Fig. 6 represent the typical signal behaviour at different temperatures. The signal to noise ratio (SNR) degrades minimally from 42 dB at 30 °C to 38 dB at 180 °C, only. Therefore the sensor is suitable for a wide range of applications.