SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 19MCE402 – AUTOTRONICS

IV YEAR / VII SEMESTER

Unit 3 – Exhaust Gas Oxygen Sensor

Oxygen sensor

- The oxygen sensor is an instrument for managing the exhaust emissions of petrol, diesel and gas engines. It is an oxygen concentration sensor which measures the residual oxygen content of the exhaust gases
- The oxygen sensor is an instrument for managing the exhaust emissions of petrol, diesel and gas engines. It is an oxygen concentration sensor which measures the residual oxygen content of the exhaust gases and then transmits a signal to the engine management system in the form of an electric voltage. The oxygen sensor voltage allows the control unit to detect whether the mixture is too lean or rich. The control unit reduces the quantity of fuel in the A/F ratio if it is too rich, and increases it if it is too lean.

- value measured by the oxygen sensor allows the control unit to adjust the amount of fuel injected to attain an optimum mixture. This creates ideal conditions for treatment of the exhaust gases in the catalytic converter. This also takes account of the engine load.
- There may also be a second oxygen sensor, the diagnostic sensor (downstream of the catalytic converter). This detects whether the control sensor (upstream of the CAT) is functioning to optimum effect. The control unit can then calculate how to compensate for this.

Types of oxygen sensors

Binary sensor

- Today there are basically two different types of sensor: the binary and the wideband sensor. When at operating temperature (from 350 °C), the binary sensor generates a change in electric voltage depending on the oxygen level in the exhaust. It compares the residual oxygen content in the exhaust with the oxygen level of the ambient air and identifies the transition from a rich mixture (lack of air) to a lean mixture (excess air) and vice versa.

Types of oxygen sensors

Wideband sensor

- The wideband sensor is extremely accurate when measuring both a rich and lean air/fuel ratio. It has a greater measuring range and is also suitable for use in diesel and gas engines.
- Nowadays heated oxygen sensors are used to ensure the oxygen sensors attain operating temperature more quickly and can thus intervene earlier in the emission control process. Heated HEGO sensors no longer need to be installed so close to the engine.

Structure of the oxygen sensor

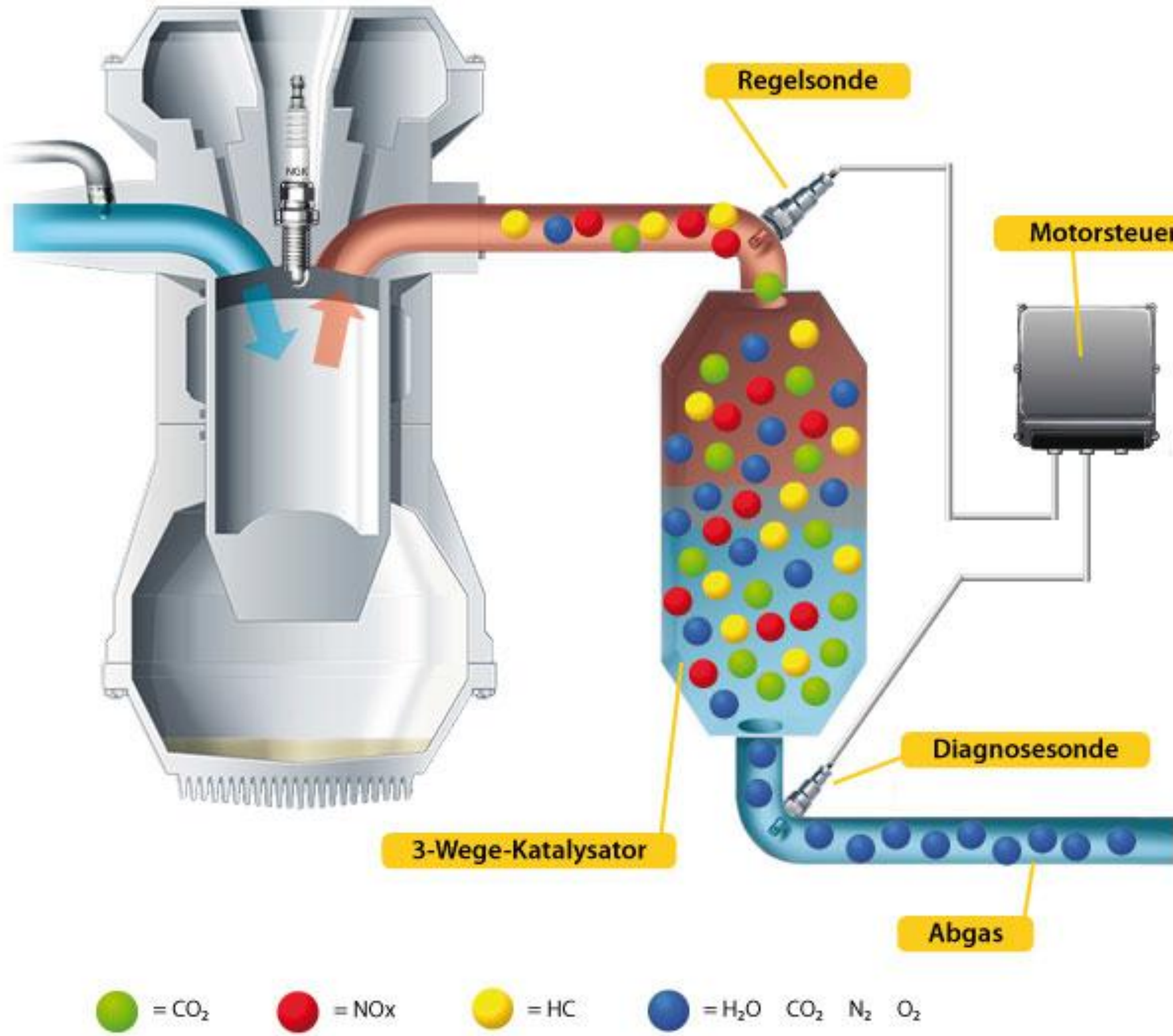
Finger-type sensor

- The core of the finger-type sensor consists of a finger-shaped ceramic element. It is heated by a heater incorporated in the sensor as control is possible only at a minimum operating temperature of 350 °C.
- The exhaust gases flow over the electrode side of the sensor element, while the other is in contact with the outside air. The outside air here acts as a reference for measurement of the residual oxygen content.
- To protect the sensor element from combustion residues and condensate in the exhaust gas, the sensor housing is fitted with a protection tube at the exhaust gas end.

Structure of the oxygen sensor

Planar sensor

- The planar oxygen sensor is manufactured using thick-film-technology.
- The shape of the sensor element resembles an elongated plate. Both the measuring cell and the heating element are integrated in this plate, so allowing the sensor to attain its operating state more quickly. Here too suitable protection tubes are used to protect the sensor element from combustion residues and condensate in the exhaust.



Regelsonde
Motorsteuerung
Diagnosesonde
3-Wege-Katalysator
Abgas
= CO_2
= NOx
= HC
= H_2O CO_2 N_2 O_2

- In order for the exhaust emissions catalyst to operate correctly, the air–fuel ratio must be kept close to 15:1 (by mass), and it is the exhaust gas oxygen (EGO) sensor that assists the ECM to keep the air–fuel ratio within the required limits.
- The EGO sensor constantly monitors the oxygen content of the exhaust gas, and hence the air–fuel ratio at the engine intake, since the percentage of oxygen in the exhaust gas is an accurate measure of the air–fuel ratio of the mixture entering the engine cylinders.

- The information (voltage) from the EGO sensor is fed back to the ECM so that the amount of fuel injected into the engine may be changed to ensure that the air– fuel ratio is kept within the required limits.
- It is common practice to refer to the air– fuel ratio that gives chemically correct combustion as lambda = 1.
- If the mixture is rich, lambda is less than 1 (probably lambda = 0.97), and if the mixture is weak, lambda is greater than
- 1 (probably lambda = 1.03). For this reason, the exhaust gas oxygen sensor is often referred to as a lambda sensor.

$$\text{Lambda} = \frac{\text{actual air-fuel ratio}}{\text{chemically correct air-fuel ratio}}$$

Thank You !