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Thermal Conductivity Detector (TCD) Selectivity

The TCD (Thermal Conductivity Detector) is **not selective** in the traditional sense like NDIR or PID sensors. That means:

- It does **not measure individual gas components directly**.
- Instead, it responds to the **overall thermal conductivity** of the gas mixture.
- Since hydrogen has a **very high thermal conductivity**, it can be detected well even in mixtures.

What does this mean in practice?

- If you have a gas mixture (e.g., air with 2% hydrogen), the presence of hydrogen significantly changes the thermal conductivity of the mixture.
- The TCD sensor detects this change and can **infer the hydrogen concentration**, **provided the rest of the gas composition is known or constant**.
- **However**, if other gases in the mixture also change (e.g., replacing air with CO_2 or CH_4), the overall thermal conductivity changes too — which can affect the measurement.

In short:

- The sensor is **not selective** to individual gases.
- It can **detect hydrogen well**, **if the background gas (matrix) is stable**.
- In **multi-component mixtures with varying composition**, calibration or compensation is needed to make selective measurements.

So how can it still be used selectively?

- By **calibrating** the sensor for a known gas matrix.
- Or by **combining** it with other sensor technologies (e.g., NDIR for CO_2, PID for VOCs) to identify the matrix and correct the TCD reading.