

# TiO<sub>2</sub> BASED DUAL RESPONSE OXYGEN SENSOR MATERIAL

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Our work demonstrates how TiO<sub>2</sub> based material can be used as the working body of an oxygen gas sensor. TiO<sub>2</sub> is a well known material in the world of electrical metal oxide gas sensors [1]. However, we have shown in our previous works that TiO<sub>2</sub> can also be employed as an optical gas sensor [2]. In the present work, the TiO<sub>2</sub> based material functions as a 2 in 1 sensor where the material operates simultaneously as an optical and electrical gas sensor. The electrical signal is collected by monitoring the conductivity of the sensor material. The optical signal is recorded by monitoring the intensity of photoluminescence (PL) emission from the material. The PL is generated in the material by shining UV light on it.

The electrical and optical sensor signals both depend on the amount of oxygen in the surrounding gas environment, so both can separately be used for measuring oxygen content in gas. However, we show that by using both signals simultaneously, it is possible to improve the precision of the sensor significantly. In order to do this, we put the material into an environment, where the oxygen content varied randomly over time. This way we collected data on how the two sensor signals behave in various oxygen environments. Afterwards we used standard machine learning tools to build models that predict the oxygen concentration based on measured PL intensity and electrical conductivity.

## References

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2. M. Eltermann, K. Utt, S. Lange, and R. Jaaniso, "Sm<sup>3+</sup> doped TiO<sub>2</sub> as optical oxygen sensor material," *Optical Materials*, vol. 51, pp. 24–30, Jan. 2016. <https://doi.org/10.1016/j.optmat.2015.11.020>

