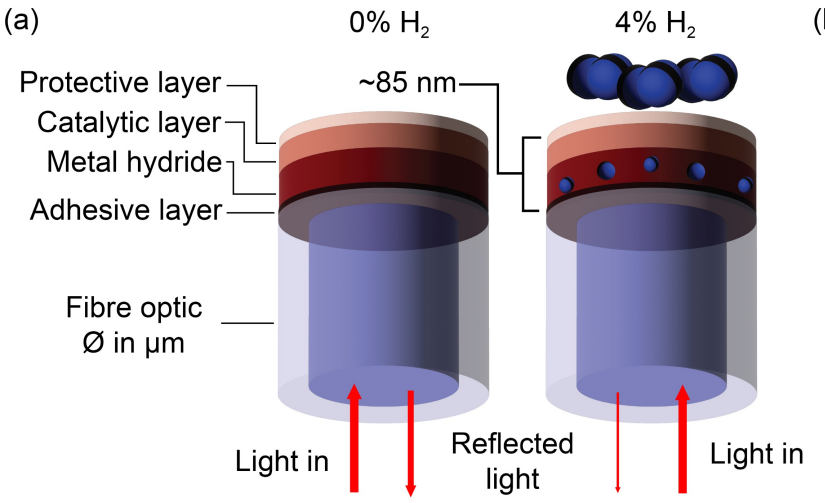
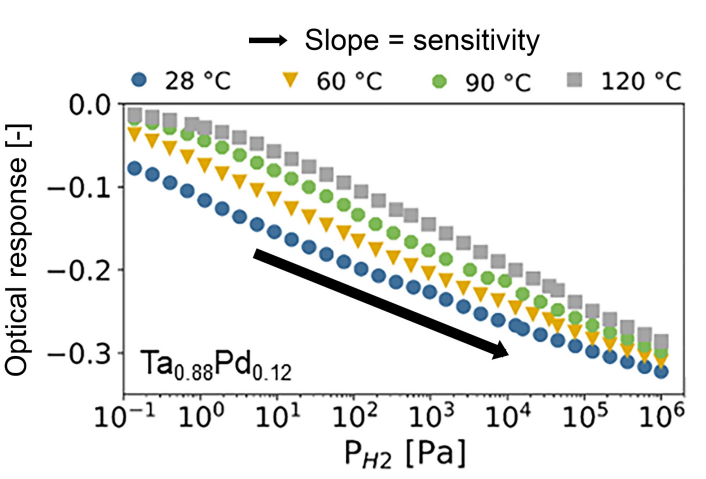
4TU. Energy

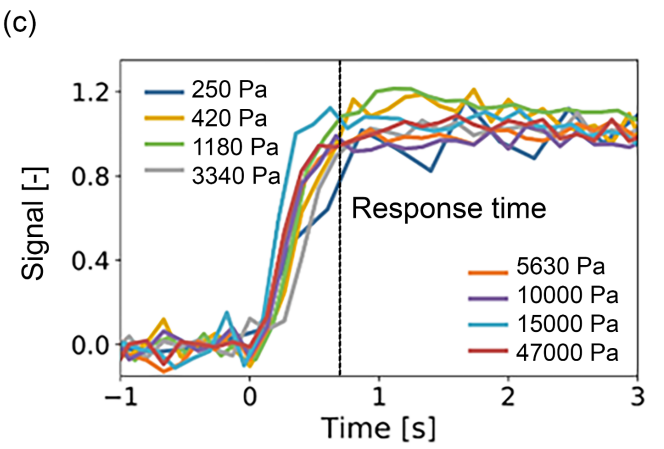
Optical hydrogen sensors

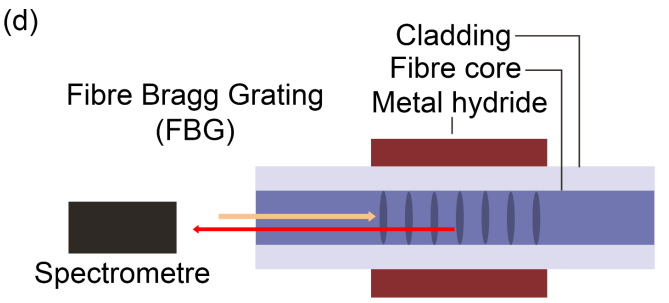
A safety requirement for hydrogen fuelled aircrafts

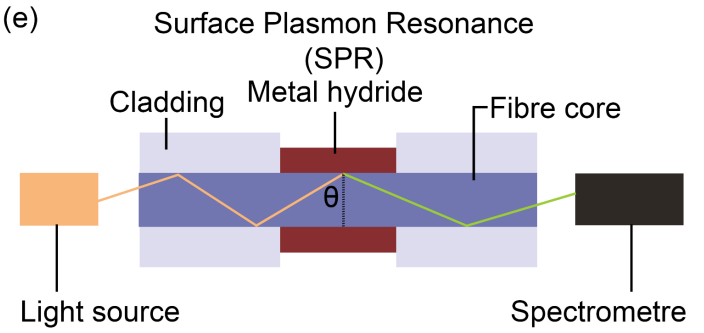
Hydrogen can provide three times more energy than gasoline combustion per unit mass without emitting CO_2 which makes it an attractive clean energy carrier. Hydrogen fuelled aircrafts require compact hydrogen sensors that perform well at a wide range of temperatures to detect leakages and prevent fire. Optical sensors are compact and can be optimised for various working temperatures.











Working principle:
Upon exposure to hydrogen, metal hydride absorbs hydrogen, changing its optical properties as illustrated in (a).

Findings related to Ta-based metal hydride:

- Wide sensing range at various working temperatures (b).
- No hysteresis behaviour (b).
- Response time less than 1 second (c).
- Alteration of sensing range is possible via alloying and/or nanoconfinement.

Next steps:

- Applying this material to various types of optical geometries, such as FBG (d) and SPR (e).
- Exploring wider temperature range, particularly between -60°C and 270°C that is a relevant condition for hydrogen storage and aircraft engines.

TU Delft

In collaboration with:

CLEAN AVIATION

AIRBUS

OVERLEAF

Contact persons

Sandra Dewi H.S.Dewi@tudelft.nl
Lars Bannenberg L.J.Bannenberg@tudelft.nl

Reference for the graphs: Bannenberg, L., Schreuders, H., & Dam, B. (2021). Tantalum-Palladium hysteresis-free optical hydrogen sensor over 7 orders of magnitude in pressure with sub-second response. Advanced Functional Materials, 31(16), 2010483.