

Licensing Opportunity

High-temperature protection coating with built-in thermal sensor

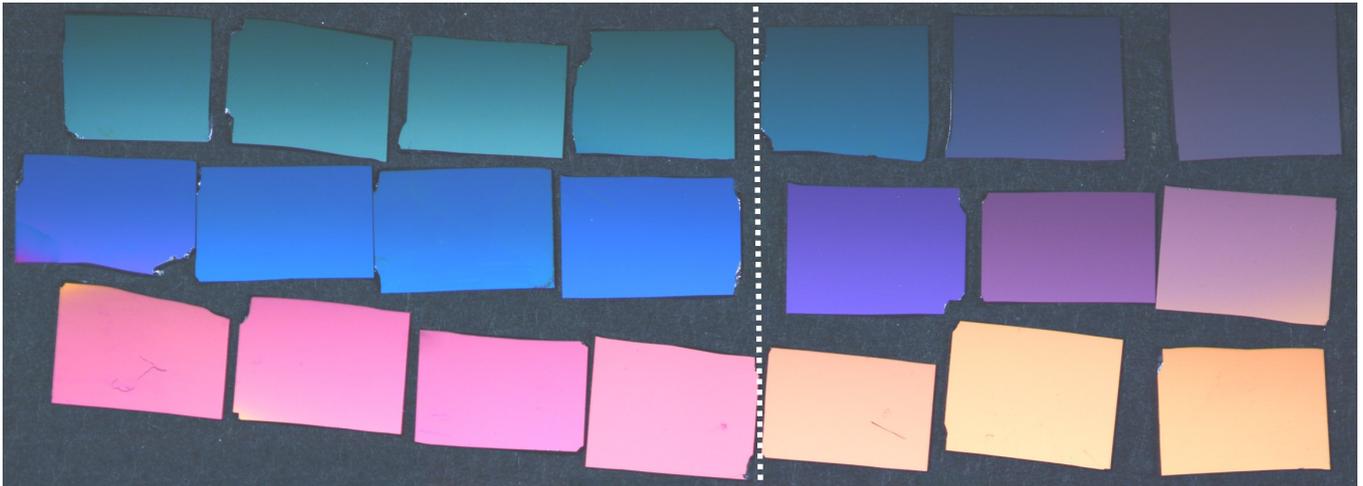


Fig. 1 The photo shows top to bottom three metal sheets with 70 nm, 43 nm and 23 nm TiAlN on TiN, respectively. The sheets have been exposed to 25°C (left) to 900°C (right). Beyond 500°C (dotted line) the thermal sensor visibly starts responding. The onset can be tuned.

Summary

A new functional coating warns against thermal loads by irreversibly changing its colour. The coating can be used on components, which are prone to material degradation from thermal loads, in order to make inspections fast and easy.

Background

Indicating local spots of thermal load on large-scale components is challenging, because the area of interest may not be accessible by electronic sensors or the complete coverage of the area may require an excessive number of sensors.

Invention

The hardware of interest can be covered with a new functional coating, which will indicate the thermal history. First, a layer of TiN is applied, then an ultrathin layer of TiAlN. When exposed to high temperatures (> 500°C) the TiAlN decomposes into TiN-rich and AlN domains which is accompanied by a blue-shift in the absorption spectrum (fig. 1). Proof-of-concept experiments have been carried out. Additional benefits of the coating are wear and oxidation resistance, which makes it applicable to harsh conditions.

Features & Benefits

- Hard protective coating, with corrosion protection up to 900°C
- Coating shows local thermal history
- Qualitative inspection by eye, quantitative inspection by spectrometer

Fields of Application

- Thermal sensors in the high temperature range
- Monitoring of products suffering from thermal loads in harsh environments (boilers, pipes, turbines, turbine blades, bearings)

Patent Status

- Patent pending

Publication

- V. Schnabel, R. Spolenak, M. Doebeli, H. Galinski, "Structural color sensor with thermal memory: Measuring functional properties of Ti-based nitrides by eye", <https://doi.org/10.1002/adom.201800656>

Technology Readiness Level



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