FRONTIER
High stability metal coated fibre optics for distributed monitoring of high temperature infrastructure

High Stability Metal Coated Fibre Optics for Distributed Monitoring of High Temperature Infrastructure

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AIMEN Technology Centre

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Sustainable Manufacturing Processes

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Problem to be solved

Fiber Optic Sensors (FOS) are made of silica (SiO_2)

- Comercial FOS can't be use >450°C for a long term
- In harsh environments (corrosion, vibration, etc) their durability decreases drastically

FRONTIER

- **Monitoring** industrial processes and/or equipments **working over 400°C**
- Embedding FOS in metals for SHM or intelligent structures

Power Generation

Aircraft

Nuclear

Metal casting

FRONTIER Technology: Solution and Benefits

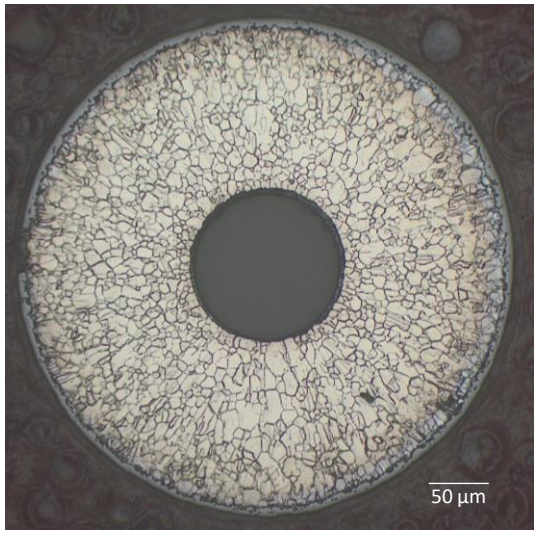
FRONTIER SOLUTION

- **New nickel (Ni) automated and continuous coating system** for **FBG** and **Distributed Fibre Optic Sensors (FOS)**
- **Unique technology** in the **market** → **Patent pending**

EQUIPMENT CAPACITIES

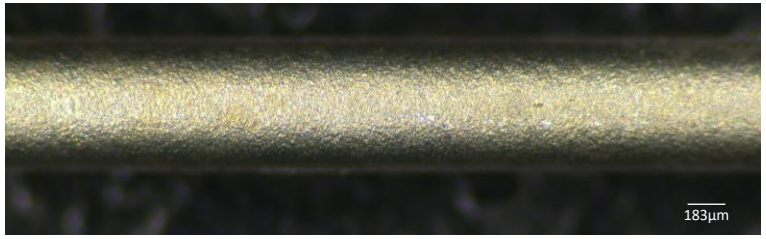
- **Continuous coating process**
- Average **coating speed**: **20 m/h**
- **Customizable** coating layer **thickness**: from 15 ± 1µm to 500 ± 60 µm
- **Control** and **monitoring**: temperature, coating speed, coating quality, tensile…
- **Versatile:**
  - **Usable** for other **metals** when optimized
  - Usable for **FBGs** and **optical fibres**

Microstructure of a thermally treated Ni coated optical fibre. It was exposed to cycles of temperature up to 800°C for 25 days



COATED OPTICAL FIBRE PROPERTIES

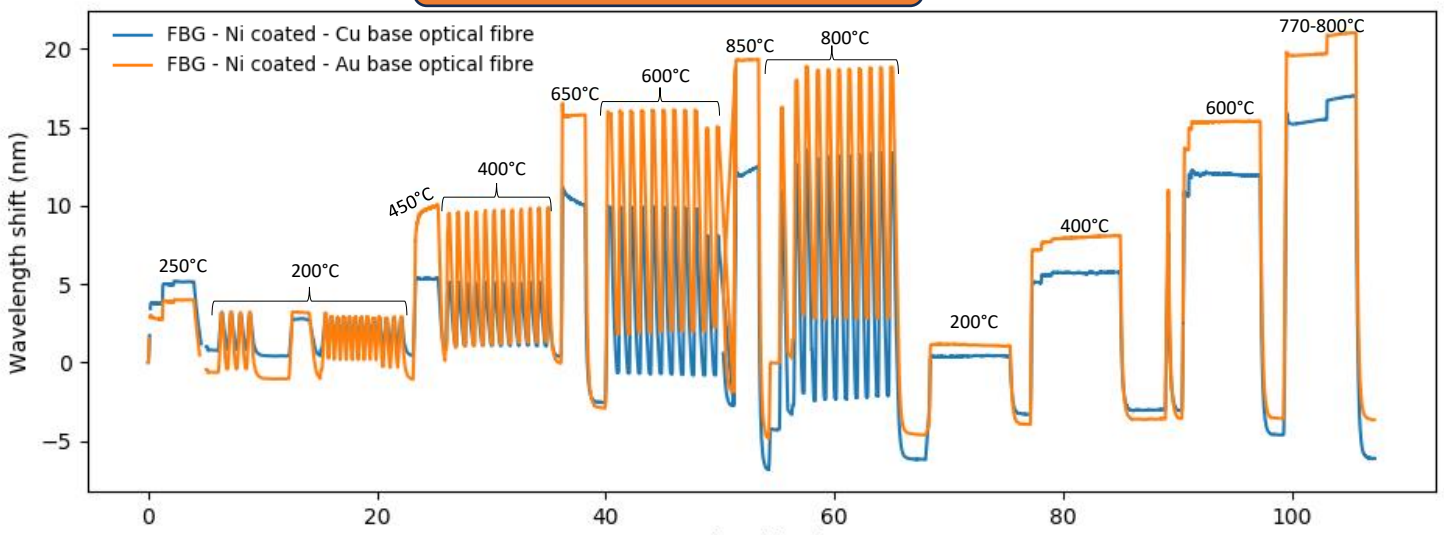
- **Homogeneous** custom **coating**
- **Manipulable:** fibres do not easily deteriorate/break
- **Highly accurate:** measurement of strain (±1 µε) or temperature (±0.1°C) without loss of resolution
- Thermal performance:
  - Long term temperature (> 300 s): 700°C
  - Short term temperature (< 300 s): 1000°C
- Coated fibre can be **embedded by welding, laser, ultrasound or other techniques**
- **Cost-effective:** Ni cheaper than current alternatives (gold, shapphire)

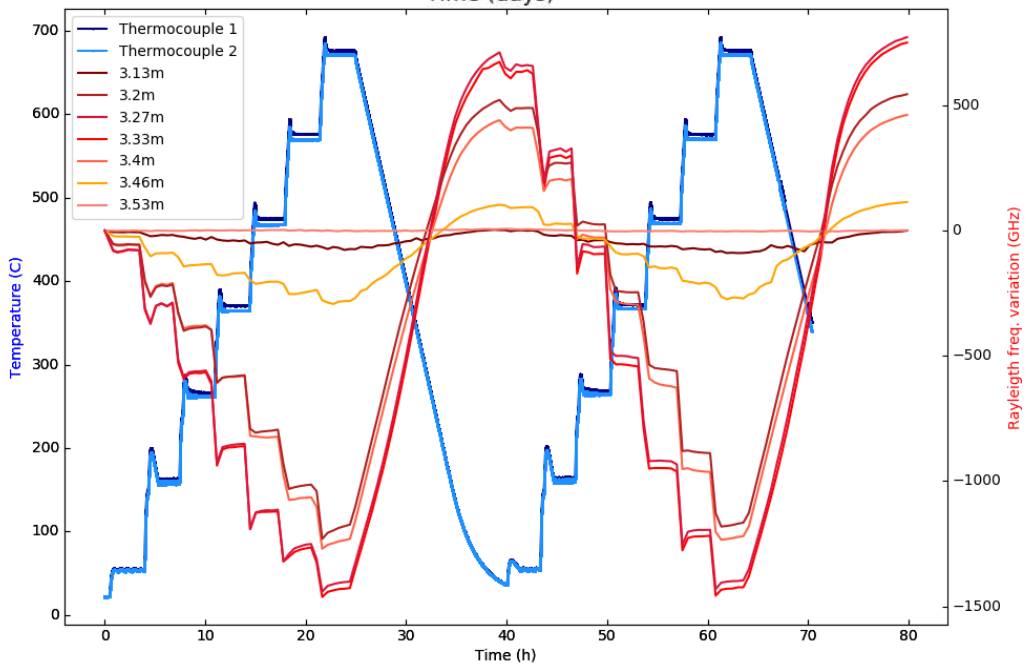


Homogeneous Ni coating

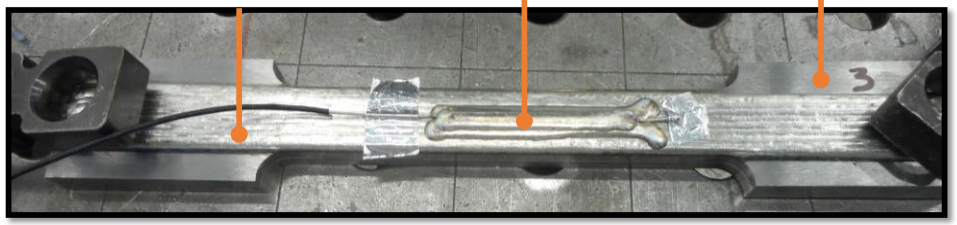
Performance tests

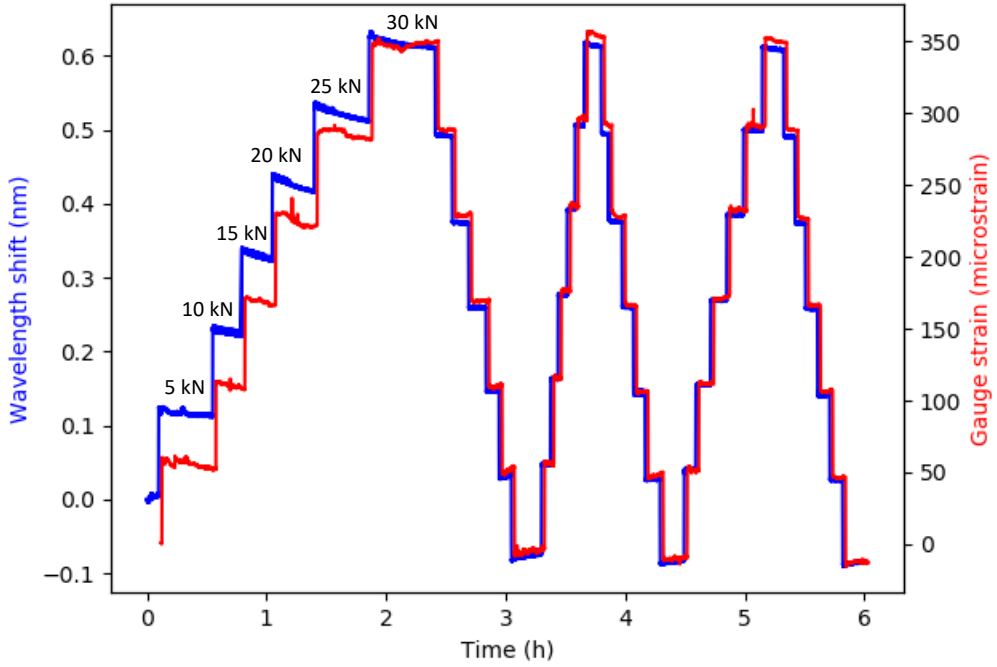
Thermal tests





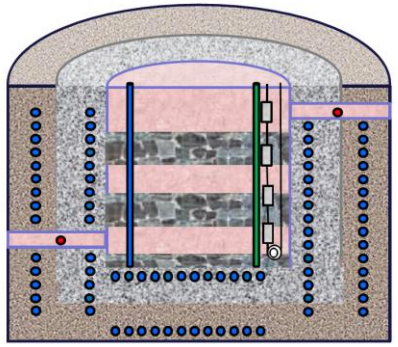
Mechanical tests



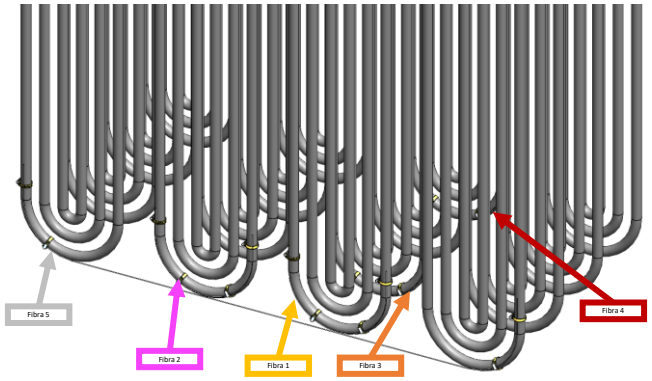


FRONTIER's applications

Power generation



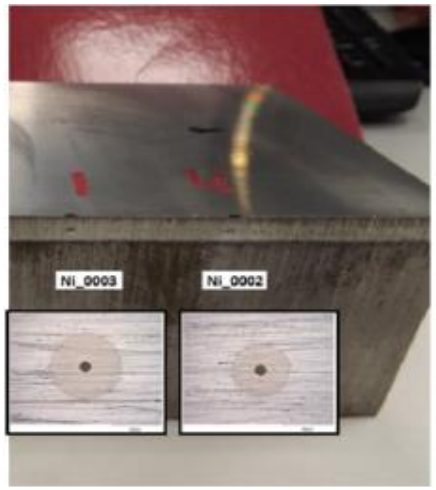
Temperature and strain monitoring in an **energy storage concrete tank** of a **Concentrated Solar Power Plant**



Monitoring a **superheated biomass boiler** and a **superheated combined cycle boiler** during one year of normal operation

Naval

Multimaterial off-shore wind tower scale (1:10) with embedded metallic coated FOS to monitor corrosion



Embedded Ni coated FOS in the **antifriction material** by manual and laser TIG welding

Aerospace
Railway
Nuclear
Metallurgy
…

FRONTIER Commercialization

- **IP Status:** Patent pending
  - Coating method
  - Coating Equipment Design Specifications
- **Commercialization:**
  - IP Licensing
  - Contract Manufacturing Services for small orders: tests, pilots.
- **Identified targets:**
  - Specialty fiber and/or FOS manufacturers interested in harsh environments

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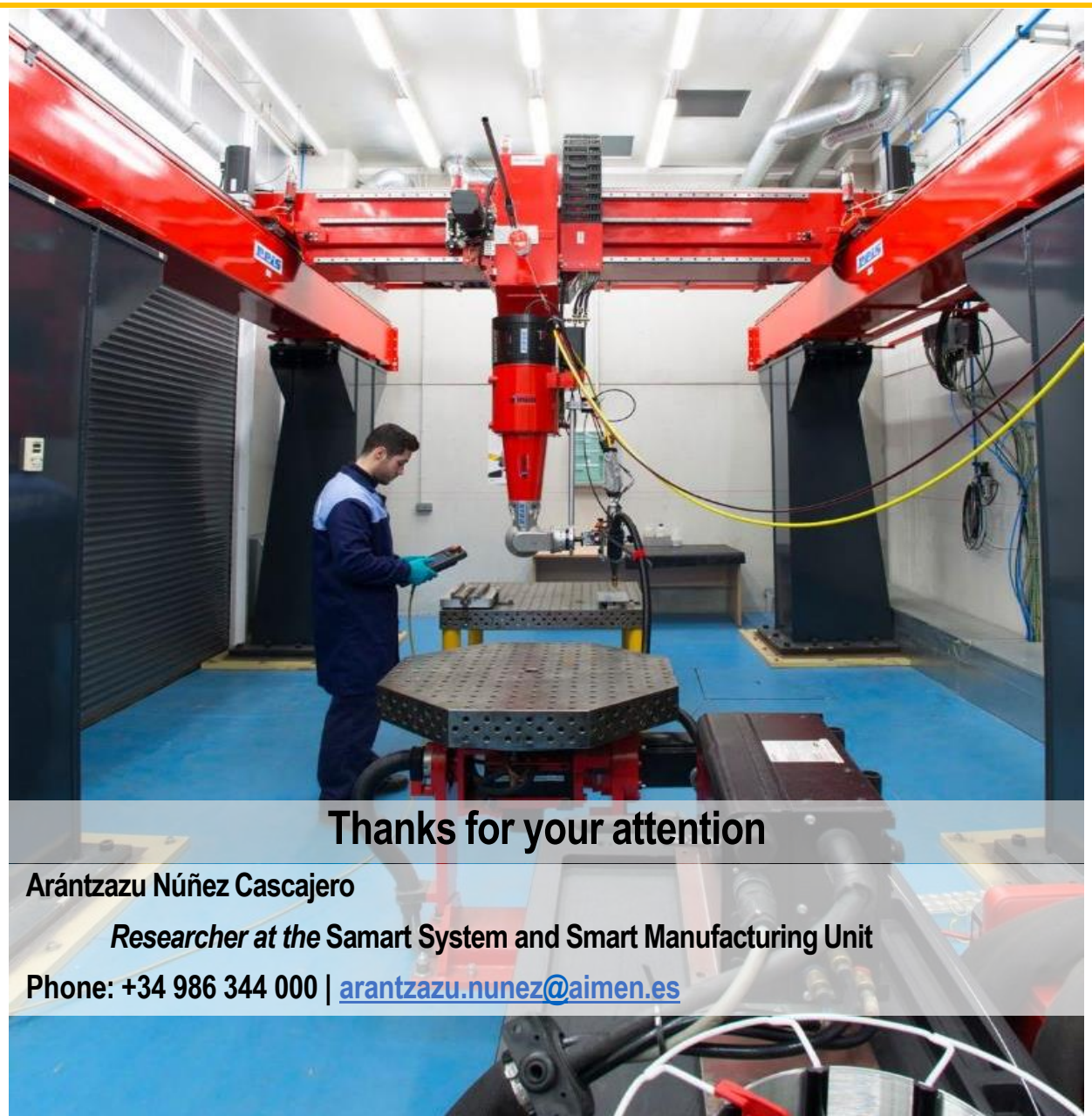

Thanks for your attention

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