

Industrial photonics

Assignment 04



**Politecnico
di Torino**

A Review on Optical Fiber Sensors for Environmental Monitoring

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Environmental monitoring, nowadays is a must for most facilities. In the ones that happens to operate in **harsh conditions**, optical fiber sensors (**OFS**) have some great **advantages**:

- **resistance** to electromagnetic **interference**
- **resistance** under extreme **pressure**
- **resistance** under extreme **temperature**
- low **losses**
- small **sizes**



Cable layer vessel "Leonardo da Vinci"

Comparison between sensors

Electrochemical

- low power
- linear
- selective

Micro-electromech.

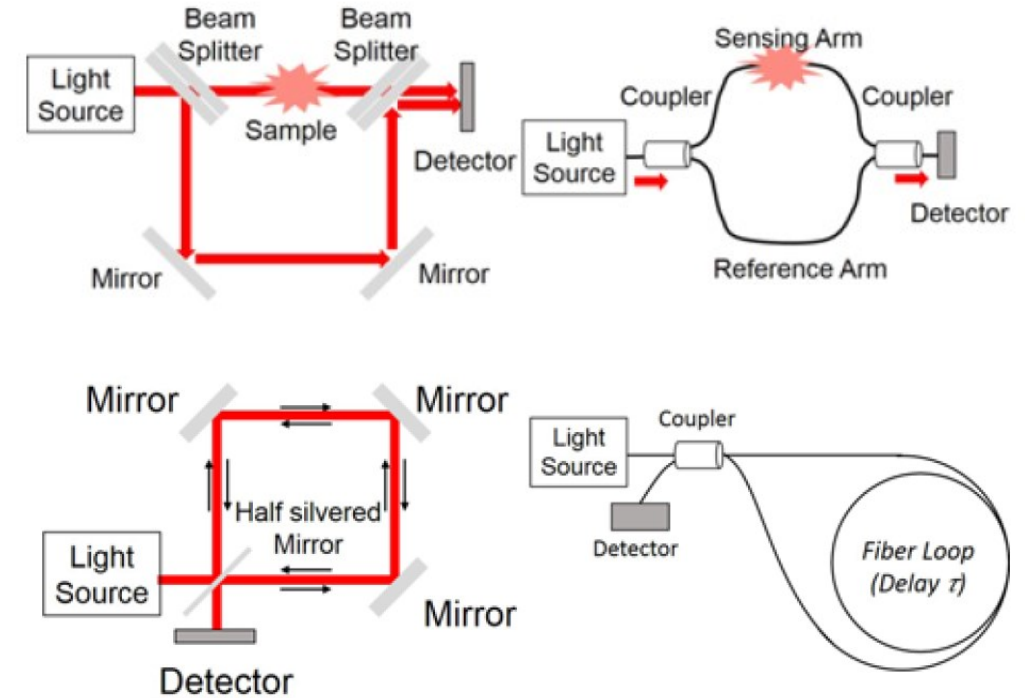
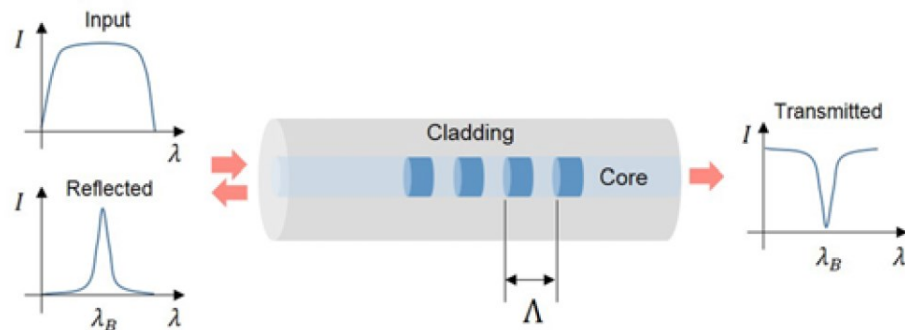
- small size
- cheap
- short life
- disturbance

Optical fiber

- high **bandwidth**
- compatible with existing infrastructure
- **resistance** to electromagnetic **interference**
- **resistance** under extreme **pressure**
- **resistance** under extreme **temperature**
- low **losses**
- small **sizes**

Types of OFS

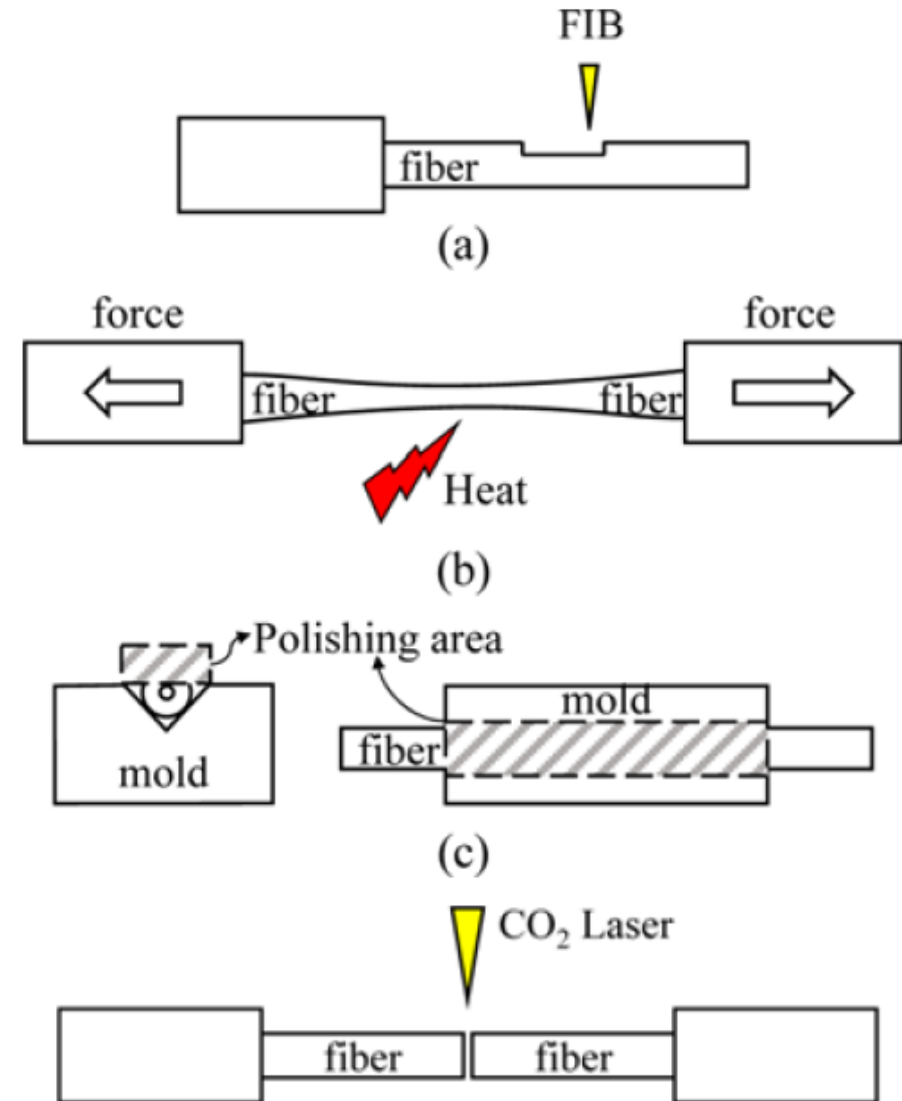
- **Point-Based** – sensitivity / selectivity
 - fiber **gratings** (sensing T , ε , correlated)
 - **inline** interferometer (a lot of phis. quantities)
- **Distributed** – spatial and temporal domain
 - Optical **Time-Domain** Interferometer
 - Optical **Frequency** Interferometer



From Bulky equipment to fiber based

Fabrication process

- **Grating inscription**
 - Laser processing of the **core** of the fiber without damaging the **coatings**
 - Interference **lithography**
- **Functional coating**
 - **Physical** vapor deposition
 - **Chemical** vapor deposition
 - **Atomic** layer deposition
- **Shaping**
 - Machining
 - Tapering
 - Polishing
 - Splicing



Example of application

- **Earthquake** monitoring (or well)
- **Oil and Gas**
 - Leakages
 - Corrosion
 - Span **hundreds of km** with a **resolution** in the orders of **meters**
- **Civil**
 - **Dams/landslides/dikes**
 - **Structural** health monitoring
- **Aviation/Space**
 - **Real time** monitoring of **composite** materials
- **Agriculture**
 - **Air/Soil/Water/Chemical** monitoring

