CHARACTERIZATION OF MATERIALS BY MEANS OF LASER-BASED TECHNIQUES

POSTER P_22

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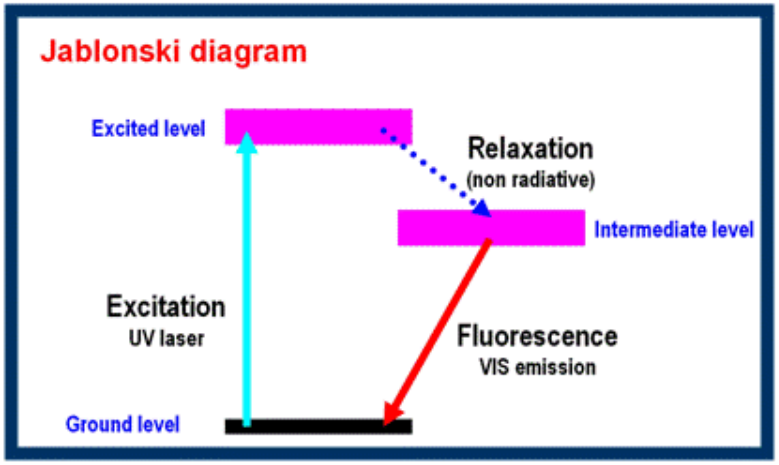
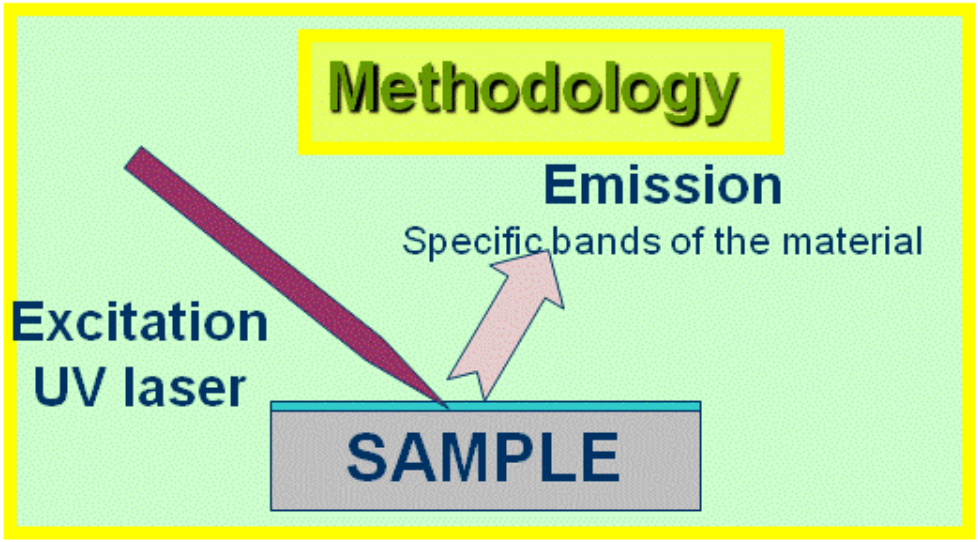
LIF TECHNIQUE FOR SURFACE ANALYSIS

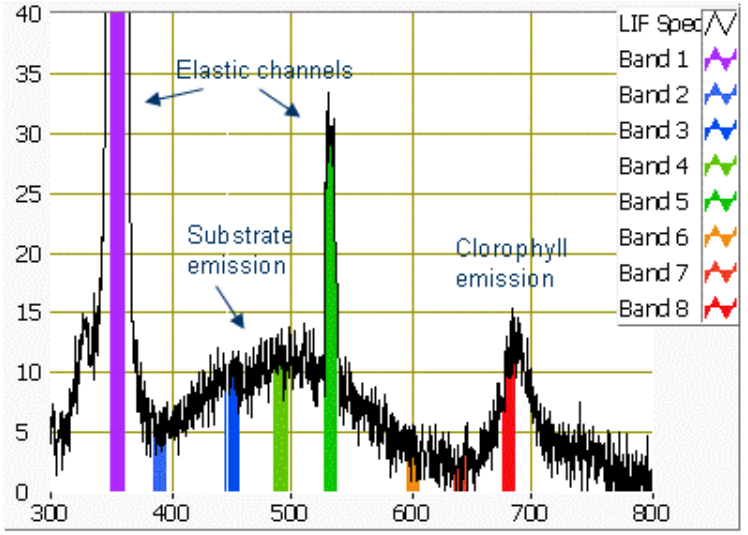


Laser Induced Fluorescence Process

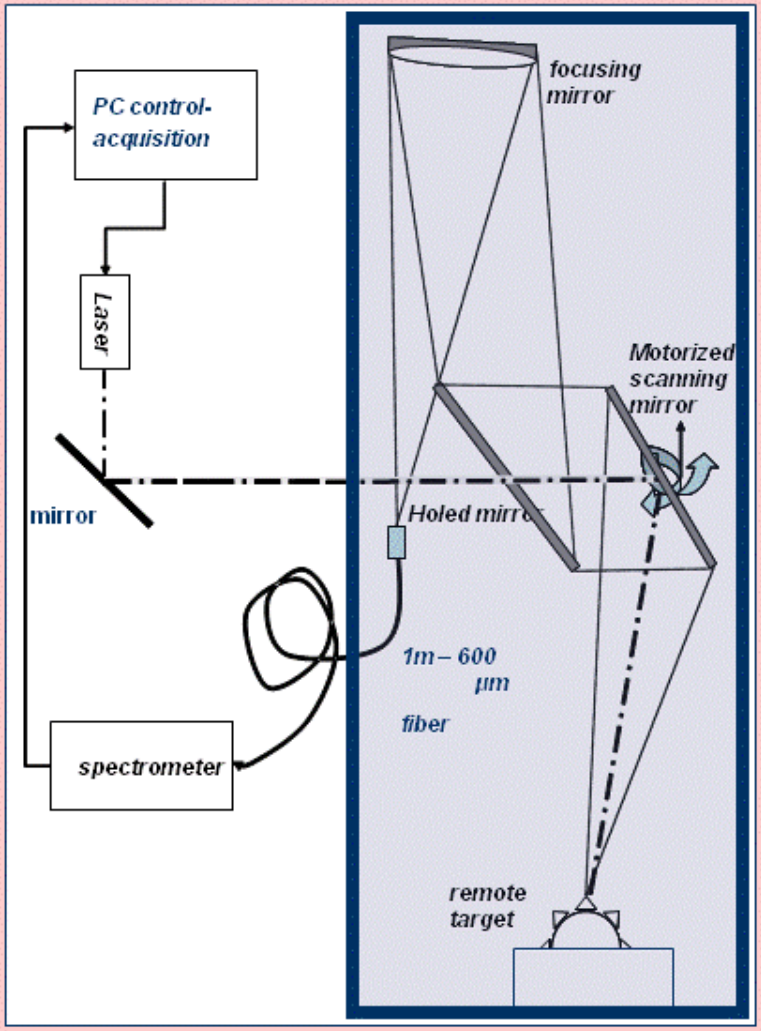
The emission of radiation by luminescent materials is observed whenever an absorption of energy sufficient to activate allowed electronic transitions occurs.
Laser Induced Fluorescence is generated after the absorption of UV radiation.

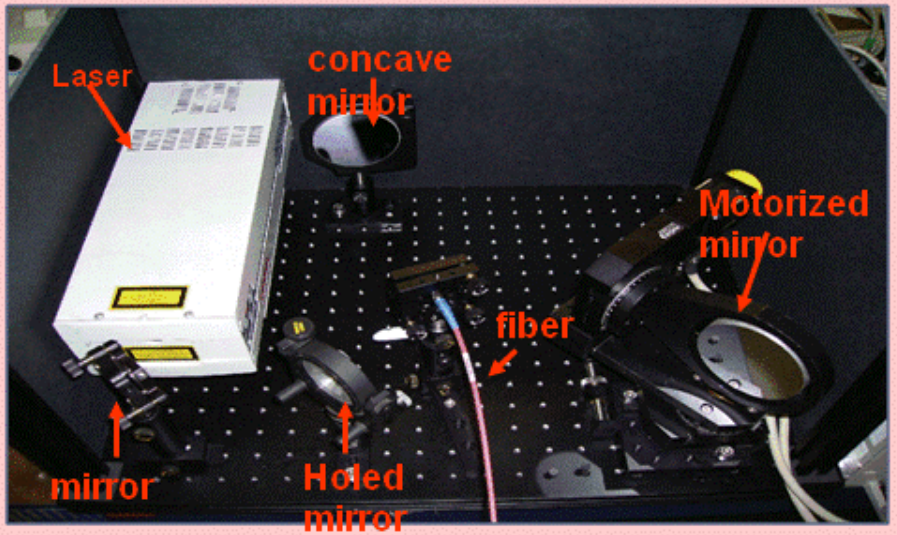


Typical LIF spectrum



LIF APPARATUS





Laser Nd:YAG 266 nm, 355 nm
3 mJ, 10 ns, 20 Hz

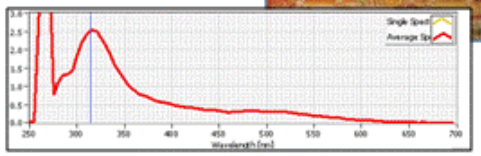
Spectrometer 250-1100 nm
CCD Array

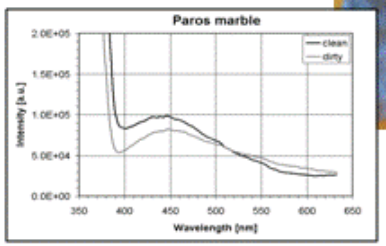
System advantages

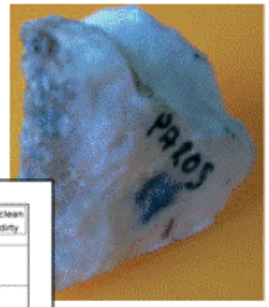
- Compact (58x43x36 cm)
- Remote (10m)
- Light (15kg)

LIF scanning Instrumentation for field campaigns

Range 2 - 20 m Resolution ≈ mm

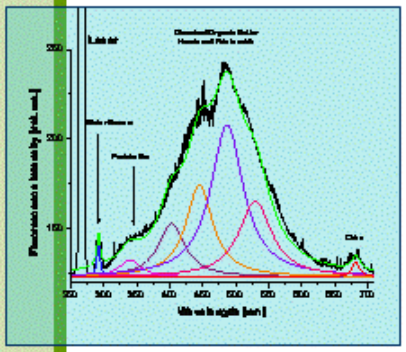


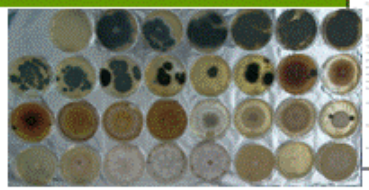


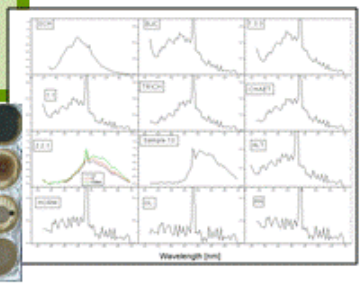


LIF APPLICATIONS

- **Cultural Heritage materials:** stones, painted woods, decorated ceramics, frescoes, pigments (inorganic, organic), binders(historical, modern)
- **Building materials** (marble, tuff)
- **Biodegrading agent** (fungi, algae, lichens)
- **Environment** (LIDAR Fluorosensor)



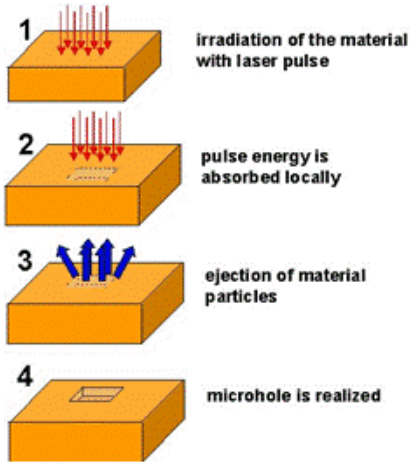




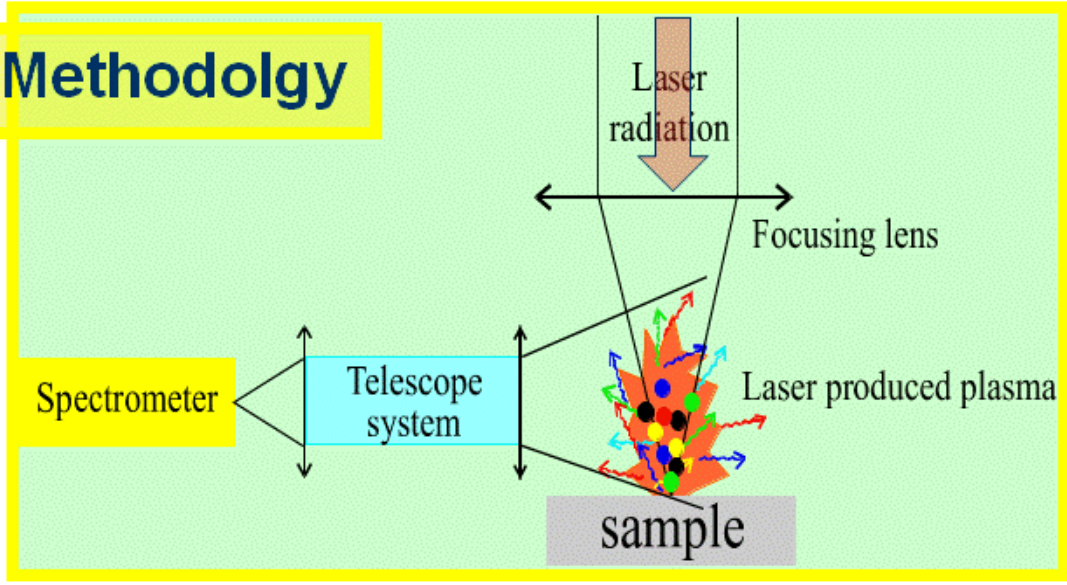
LIF specific advantages

- Real time
- In situ, no sample preparation
- Non destructive, minimal invasiveness
- Not expensive

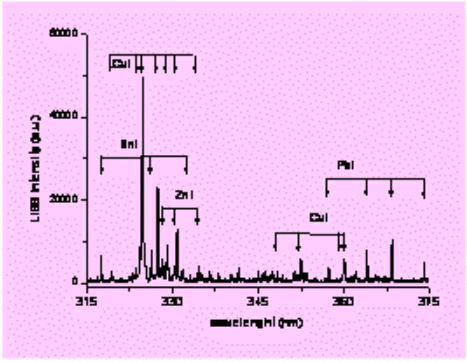
LIBS TECHNIQUE FOR SURFACE AND SUBLAYERS ANALYSIS



Methodolgy



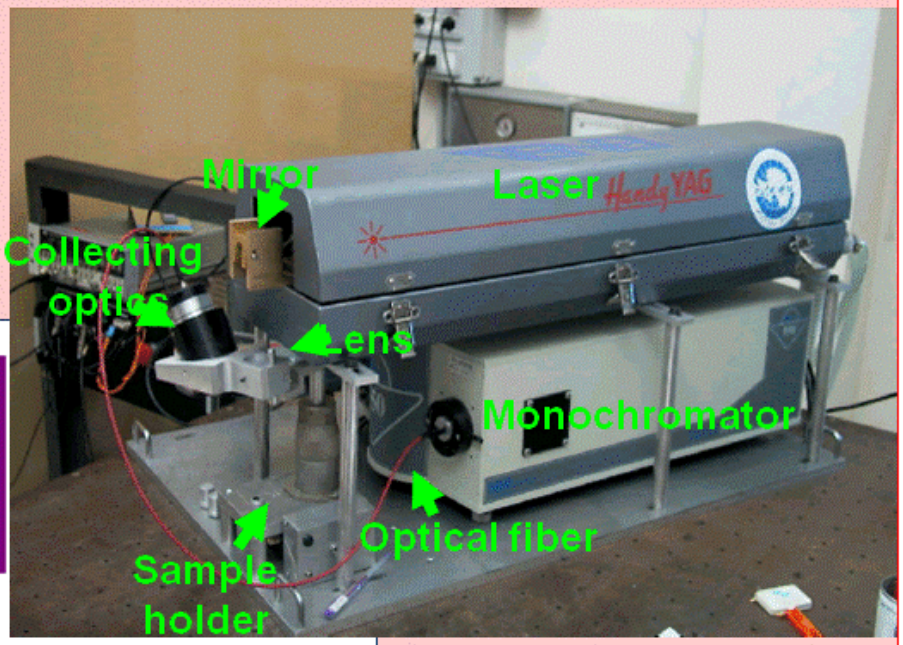
Typical LIBS spectrum

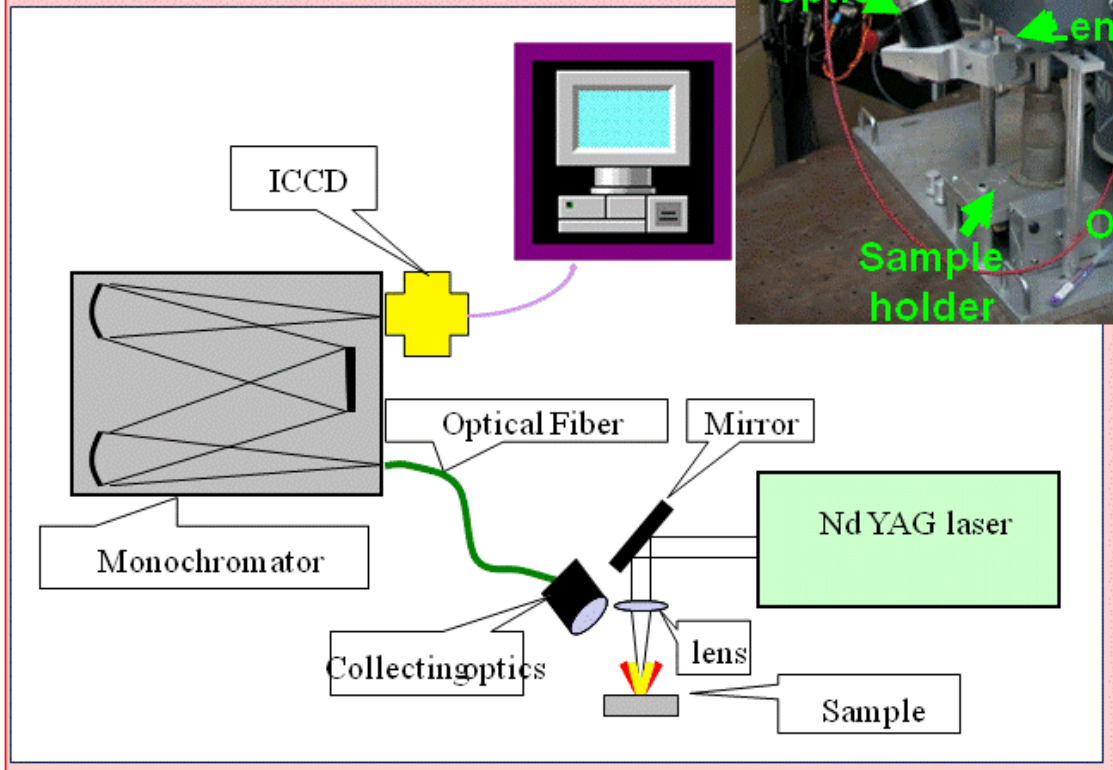


1. Laser induced ablation at the sample surface
2. Plasma expansion and decay
3. Time resolved acquisition of the spectrally resolved signal

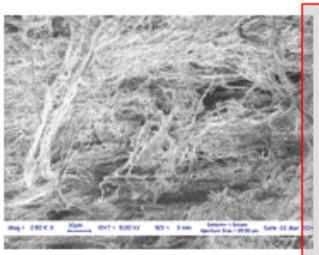
LIBS APPARATUS

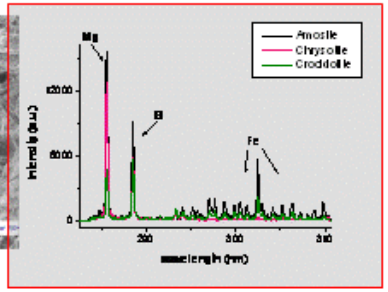
Laser Nd:YAG 1064 nm, 8 ns
20-400 mJ,
10 Hz
Detection unit 180-850 nm

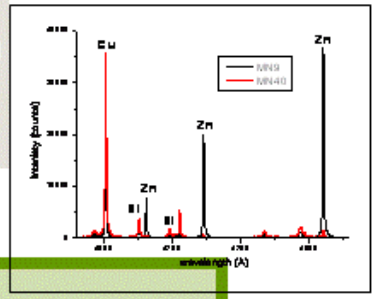




Acquisition parameters (Energy laser, shots number, Delay, gate) depend on the specific application.

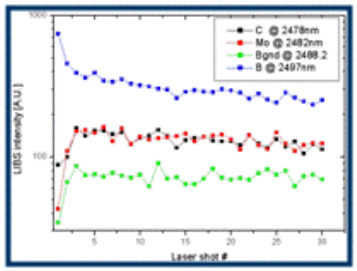




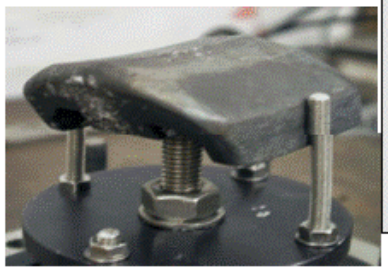


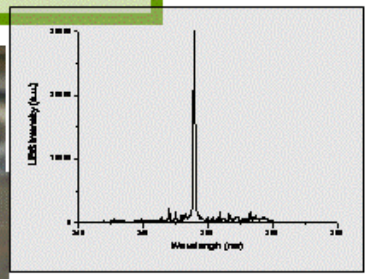
LIBS APPLICATIONS

- **Environment** (soils, sediments, asbestos) and planetary exploration (rocks, dust)
- **Artwork** (ceramics, pigments, bronze alloys, marble, fragile substrates)
- **Security** (Explosives, Bacteria, nuclear isotopes)
- **Fusion** machine analysis



Stratigraphic analysis





LIBS relevant advantages :

- Quick technique
- no sample preparation is required
- It is sufficient to ablate less than 1 μg of material at the sample surface
- *in-situ* measurements
- possible use in hostile environment
- on-line data analysis

CONCLUSIONS

- Laser-based techniques can be used in the field of materials analysis with good results
- Many fields of applications are possible
- The experimental conditions need to be improved and optimized according to the specific application.