

LABORATORY: CNR-SCITEC

NAME OF THE INSTRUMENT

ASD FieldSpec 4 High Resolution spectrometer (350-2500 nm)

GENERAL DESCRIPTION:

In the last years, in-situ UV-VIS-NIR reflectance spectroscopy has become an effective non-invasive technique for the identification of different organic and inorganic materials in art objects such as paintings, manuscripts, textiles, etc. The absorptions due to electronic and vibrational transitions in the broad spectral window from visible to SWIR (400-2500 nm), can be exploited for the identification of most of the pigments and the characterization of several organic materials.

TECHNICAL DESCRIPTION:

ASD FieldSpec® 4 Hi-Res High Resolution spectroradiometer (350-2500nm), Malvern Panalytical

The instrument is equipped with three detectors: a 512 element silicon array detector for the 350-1000 nm range, and two InGaAs Photodiodes (TE Cooled) for the 1000-1800 and the 1800-2500 nm ranges. The spectral resolution is 3 nm in the VNIR range (350-1000 nm) and 10 nm in the SWIR range (1000-2500 nm). A complete spectrum can be recorded in the scanning time of 0.1 s.

The instrument is supplied with a 1 m long optical fiber directly connected to the spectrophotometer with a 25° FOV. Using an external lighting consisting of a 12V quartz-tungsten lamp with ventilated cooling (placed at 45° with respect to the surface) and the permanent fiber (placed perpendicular to the surface), measurements with CIE 45/0 geometry can be carried out. The lateral resolution in this setup depends on the working distance: indicatively, the measurement area is about half of the working distance. Alternatively, the instrument is equipped with two bifurcated fiber optic systems (*large and small diameter reflectance probe*) which can be connected to the permanent fiber and to an external source with nominal power 12VDC, 30W. The *large diameter reflectance probe* consists of 156 fibers (200 micron), 78 for the excitation and 78 for collecting the reflected light, the stainless steel tip has a diameter of 6.3 mm. The large diameter fiber can be used with a collection probe for reflected light at approximately 20°. The *small diameter reflectance probe* is composed of 6 illumination fibers (600 microns) surrounding a single collection fiber (600 microns), the stainless steel tip has a diameter of 6.3 mm.

Spectralon™ is used for the white reference calibration. RS3 Software Package A3500370 is used for data acquisition. A backpack and batteries are provided to perform standing up analysis.



FURTHER INFORMATION:

- Romani A., Clementi C., Miliani C. and Favaro G., “Fluorescence Spectroscopy: a powerful technique for the non-invasive characterization of artworks”, *Account Chem. Res.*, 43, 837- 846 (2010).
- Romani A., Clementi C., Miliani C., Brunetti B.G., Sgamellotti A. and Favaro G., “Portable equipment for luminescence lifetime measurements on surfaces”, *Applied Spectroscopy*, 62, 1395-1399 (2008).
- Romani A., “Steady-state and time-resolved luminescence for in-situ characterization of polychrome artworks”, *Luminescence*, 23, 262-263 (2008).
- Pallipurath A.R., Skelton J.M., Ricciardi P., Elliott S.R., “Estimation of semiconductor-like pigment concentrations in paint mixtures and their differentiation from paint layers using first-derivative reflectance spectra”, *Talanta*, 154, 63-72. (2016).

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