**Industrial femtosecond pulsed laser**

**Equipment:** Femtosecond laser (NKT Photonics, Origami-10XPS)

**No. of Equipment:** TUL13

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**Equipment Description**

Industrial femtosecond pulsed laser (OnefiveOrigamy XP, NKT Photonics)

Technical parameters:

* Wavelength: 1030 nm
* Spectral line width: < 5 nm
* Pulse duration: <400 fs
* Max pulse energy: 70 µJ
* Repetition rate: 75 kHz
* Max average output power: 5 W
* Beam Quality (M²):≤ 1.2, TEM00
* Ellipticity: < 0.1
* Laser beam diameter: 5 mm
* Polarization: Linear, > 100: 1
* Pointing stability: < 30 μradrms (12 h) constant temperature< 5 μrad / °C 18 - 35 °C
* Amplitude noise: < 1 % rms
* The laser is equipped with a scanning head (intelliSCAN 14, SCANLAB) with the characteristics:
* Aperture: 14 mm
* Marking speed: 2 m / s
* Scan angle: maximum ± 0.35 rad
* High write quality: 480 cps
* Step response time in 10% full range: 3.0 ms
* F-Theta lens for scanning: 160 mm focal length
* Scanning field size: 60 mm x 60 mm

**Specification of expertise relevant to NanoEnviCzworkpackages:**

**WP3** a, c, e, f, h, **WP5** c

**Detailed description of expertise**

**Please, specify the main research topics connected with equipment**:

The equipment is mainly used for the production of high-quality nanomaterials through the synthesis approach known as Laser Synthesis of Colloids (LSC), a versatile and highly reproducible technique that enables the synthesis of complex nanostructures from almost any kind of solid material. Essentially, an ultrafast laser source that can deliver peak intensities above 1013 W/cm2 in shorter times than the conventional electronic relaxation time (10-12 s), is used to irradiate a solid target, which is immersed in a liquid medium. The extreme laser-matter interaction leads to the efficient detachment of small pieces from the material, which causes the synthesis of colloids containing the desired nanostructures.

As the solid can be almost anything (metals, transition metals, semiconductors, polymers, etc…), as well as the liquid medium (polar solvents, non-polar solvents, solvents containing solutes like macromolecules, etc…), the technique enables the production of tailored nanomaterials on demand. Besides, the equipment can be used to modify bulk, micro, or nanostructured materials by laser irradiation in air.

**Please, specify the secondary research topics connected with equipment**:

Synthesis of ligand-free nanoparticles or nanoparticles functionalized with molecules on demand.Surface modification, micromachining, drilling and cuttingof materials by laser irradiation.

**Keywords describing research area:**

Laser Synthesis of Colloids (LSC), nanoparticles, colloidal nanomaterials, engineered nanoparticles, surface modification by femtosecond laser irradiation.

**Competence**

**Relevance for applied and industrial research:**

Design of high-quality nanomaterials for specific applications such as catalysis, bio-labeling, bacteria-killing, and smart fluids development, among others. Surface modification, micromachining, drilling, and cutting thick materials like glass, ceramics, and metals, among others.

**Relevance for fundamental studies:**

As the liquid environment could be almost any kind of liquid, and the solid target could be almost any kind of solid material, the LSC methodology used to prepare nanocolloids permits an unlimited number of possibilities, including the one-step synthesis and functionalization of nanomaterials by adding solutes in the liquid environment. The exploitation of such an opportunity can lead to the production of high-quality functional nanomaterials for multiple applications.

Besides, as a femtosecond pulsed laser source delivers energy in a window of time shorter than the conventional electronic relaxation time, the irradiation of solid materials can render electronic response that may enable highly specific modifications in the structure of the materials.

**Comments**