**SQUID**

**Equipment:** SQUID (Super-conducting-QUantum-Interference-Device)

**No. of Equipment: UPOL1**

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**Equipment Description**

**Description of equipment:**

A superconducting quantum interference device (SQUID) is a machine used for DC (direct current) and AC (alternating current) magnetic measurements. The main advantage compare to other magnetometers is its very high sensitivity for extremely weak signals very close to 10-15 T. Such a high sensitivity of SQUID device is reach by using Josephson junction inside the SQUID system. Josephson junction is made from two superconductors, separated by a thin insulating layer allow tunneling of electrons pass through which leads to possibility of measure only particular units of magnetic flux.

On DC measurement we recognize 2 basic measurement regimes. The first one dealing with magnetization versus temperature measurement leads to estimation of magnetic transition temperature from un-order magnetic state to order magnetic state, blocking and irreversible temperature of superparamagnetic materials and/or particle-size distribution of nanoparticles in measured system. The second type of measurement is magnetization versus external magnetic field very well known as a hysteresis loops measurement. From hysteresis behavior you can extract information about saturation magnetization, remanent magnetization and coercivity field.

In AC magnetic measurements a different AC field is applied to a sample and the resulting AC moment is measured. Because the induced sample moment is time-dependent, AC measurements yield information about magnetization dynamics which are not obtained in DC measurements, where the sample moment is constant during the measurement time. AC measurement is suitable especially in the field of molecular magnets and spin-crossover complex, in the spin-glass systems and/or in the measurement of irreversible motion of domain walls.

The samples for SQUID measurement can be in many forms including powder samples, thin films and frozen samples. The presented magnetometer offers a wide range of temperatures from 1.9 K – 800 K and the presence of external magnetic field ranging from -7 T to +7 T.

**Specification of expertise relevant to NanoEnviCz workpackages:**

**WP3**a,c-f,h, **WP4**a,b **WP5**c, **WP6**a,f **WP7**a-i, **WP8**a-f,

**Detailed description of expertise**

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

Magnetism, magnetic properties

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

DC and AC magnetization measurements

**Keywords describing research area:** magnetism, nanoparticles

**Competence**

**Relevance for applied and industrial research:**

Estimation of magnetic behavior in different temperatures and external magnetic field which is important in many industrial areas.

**Relevance for fundamental studies:**

Basic magnetic characterization fully completing obtained results from other measurement techniques and helps to understand the behavior on atomic level. Moreover from the measured curves, one can extract the information about influence of particular magnetic moment to their neighbors and determine the strength and nature of magnetic interactions.