GEMaC

Groupe d'Étude
de la Matière Condensée

AN EQUIPEX PROJECT ON DIAMOND FOR QUANTUM APPLICATIONS

At UVSQ, the GEMaC laboratory is contributing its expertise on the growth and characterisation of diamonds by cathodoluminescence to the e-Diamant project.

This technique consists of exciting the material with an electron beam focused in a nanometric volume, and analysing the light emitted. A high-resolution instrument adapted to the colour centres in diamond has been funded by the EquipEx+ project to observe and study them at the nanometre scale.

The 'colour centres' in diamond are defects in the regular stacking of carbon atoms, defects that possess some very fascinating properties: they combine optical and magnetic activity in a single atomic-sized system! They can thus absorb and emit light, which is why they are called colour centres. In addition, they behave like microscopic magnets, which react very sensitively to magnetic fields. These two characteristics allow a single defect to emit light that reveals the surrounding magnetic field: an individual colour centre can be used to measure the magnetic field at the atomic scale, with a spatial resolution of a nanometre (billionth of a metre), by analysing the light it emits.

The e-Diamant EquipEx+ project, which will be launched in 2021, aims to produce a 'quantum quality' diamond dedicated to these quantum measurement applications. This involves a whole chain of experimental techniques, including the manufacture of diamond crystals, the controlled creation of defects, the study of their properties and their integration into functional devices. The consortium brings together eleven French laboratories that are combining their expertise to build up French know-how on the manufacture of top-quality diamond for quantum sensors.

The applications of the e-Diamant project will concern a wide variety of fields. The new quantum sensors developed will in turn enable new developments, including
- new and more compact magnetic memory technologies
- understanding the chemical structures of single molecules for medicine and pharmacology
- fundamental research: characterisation of new phases of matter (especially superconductors), particularly under extreme pressure conditions;
- Extremely precise magnetic measurements in the context of earth science research (paleomagnetism).

Examples of such research include making smaller storage devices for future computing, developing new medicines, or studying paleomagnetic rocks from the formation of the Earth.
The project will last six years, with the first two years dedicated to the installation and development of the scientific equipment. It will aim to transfer some results to industry for commercial applications.

Read more:

En savoir plus

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