Letter of intent

File number 175.2021.039

Grant 2021/2022

Applicant

Title
Enhanced ssNMR for Nanomaterials, Surfaces and Non-Equilibrium Processes (NaSurNe-ssNMR)

Abstract

Relevant NWO domain: Science (ENW)
Relevant research fields:
• Chemistry: 13.50.00 Physical chemistry; 13.20.00 Macromolecular chemistry, polymer chemistry;
• Life Sciences: 21.20.00 Biophysics, clinical physics; 21.30.00 Biochemistry
• Technology: 14.10.00 Materials technology; 14.80.00 Nanotechnology
• Physics: 12.20.00 Nanophysics/technology; 12.30.00 Condensed matter and optical physics; 12.40.00 Processes in living systems

Brief explanation:
The properties of functional nanomaterials are tremendously affected by their molecular and surface characteristics, and especially dynamic processes involving both of these properties. This is true for novel human-made materials and biological macromolecular assemblies alike, with the latter being relevant to health and (ageing-related) disease. This proposal requests funds for the acquisition of versatile solid-state NMR instrumentation to be housed at the Zernike Institute for Advanced Materials (ZIAM) of the RUG, designed to provide unique insights into molecular structure and dynamics in relevant solid and semi-solid (bio)materials. The new instrument will serve the research needs of a network of investigators in Groningen and the Netherlands. It will offer a novel combination of capabilities not currently openly accessible to the Dutch research community. One central feature will be in-situ irradiation during magic-angle-spinning ssNMR designed to allow the study of transient states and phase transitions in (light responsive) materials, molecular studies of light-excitation processes, and measurements under non-equilibrium and operando conditions. It will permit in-depth studies of molecular dynamics and structural changes in light-sensitive materials, but also studies of temperature- and pH-dependent processes and phase transitions. Envisioned applications include self-assembly in supramolecular chemistry, responsive hydrogels, out-of-equilibrium macromolecular systems, and catalytic processes. A second key feature is aimed at observing surface features of functional importance for nanomaterials, thin films, but also for biomedical questions including biomarker research. The instrument will include capabilities for surface characterization, based on a combination of dynamic nuclear polarization (DNP) and fast magic angle spinning technologies. Applications will include nano-sized materials, thin films and biological nano-assemblies (e.g. from protein deposition diseases associated with ageing), without need for isotopic enrichment. Combined, these capabilities will constitute critical new capabilities for the chemical, (bio)physical and materials communities at the University of Groningen (RUG) and the rest of the Netherlands.

Researchers involved:
The instrument will serve the research needs of researchers from the RUG (ZIAM, Stratingh Institute for Chemistry, ENTEG, and others), UMCG, as well as researchers from AMOLF institute, UU, UvA, and other academic and non-academic entities across the Netherlands.

LSRI Roadmap:
The proposed instrument is complementary to the uNMR-NL network, which represents the major Dutch NMR instrumentation and is part of the Roadmap Group “Life Sciences and ‘Enabling’ Technology”. It also offers new capabilities that are complementary to those of the “Materials” Roadmap Group.
Organisation responsible for the application

Confirm letter of intent
With submitting this form via ISAAC I declare to have filled in this form completely and truthfully.

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Applicant