

Expanding the horizons of our knowledge and contributing to technological innovation, researchers delve into the fascinating realm of material testing at temperatures close to absolute zero Kelvin. This research project focuses on developing a cutting-edge experimental platform for in-depth analysis of advanced materials at temperatures of 4K (liquid helium) and 77K (liquid nitrogen).

The primary challenge undertaken by the research team is the creation of tools to monitor deformation and dissipative phenomena in materials used in superconducting magnets or in components of a liquid hydrogen storage printed from austenitic steel, during strength tests near 0K. Until now, no one has successfully conducted measurements of the full strain field at the temperature of liquid helium (4K) – ESSA!

Within the project, an experimental platform will be assembled to track the behaviour of advanced engineering materials at cryogenic temperatures. The platform will be equipped with a system for measuring the distribution of strain, temperature, applied force, and acoustic emissions during tensile, fracture and fatigue tests at 4K and 77K temperatures. Advanced engineering materials will be tested in a glass cryostat with an active and passive insulation system to maintain thermal stability at 4K.

Through these studies, it will be possible to identify dissipative effects, recognize the source of plastic flow instability, and obtain mechanical parameters of advanced materials. Furthermore, the project aims to experimentally verify constitutive models describing the behaviour of advanced materials at temperatures close to 0K.