MATERIALS SCIENCE FOR INDUSTRY AT THE ILL

The Institut Max von Laue-Paul Langevin (ILL) is an international research centre and world leader in neutron science and technology.

The EPN campus site is an international science hub in Grenoble, hosting three major European institutes - EMBL, ESRF and ILL - along with joint partnerships.

Access to the Large Scale Facilities: the example of the ILL and ESRF

Public access: The ILL and ESRF instruments are free to use for academic and industry researchers, provided results from experiments are published in the public domain.

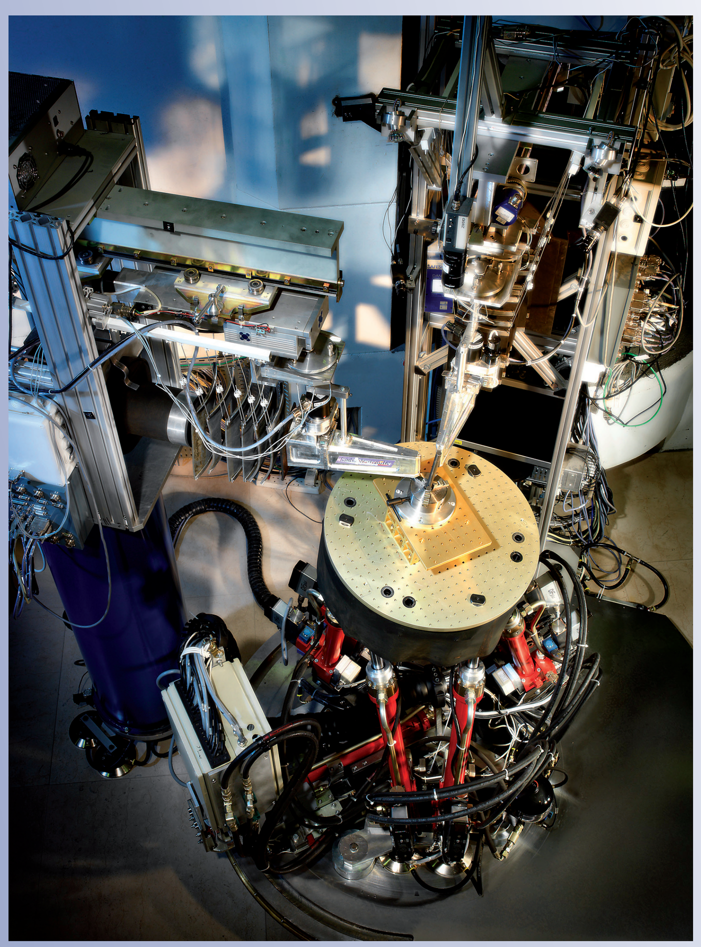
Access is subject to scientific peer review procedure.

The ILL and ESRF are also considering a new type of long-term proposal directed at technological developments in partnership with academic/industrial consortia. In return for a free of charge access, the research partners provide relevant resources. The access to these long-term proposals is via peer review.

Proprietary access: The ILL and ESRF can provide proprietary access under specific contract including beam time sale. The results are confidential, no publication is required, and the Intellectual Property belongs to the client except specific agreement. Access is faster (2 weeks minimum) than by peer review which typically entails a 6-12 month waiting period.

Neutrons for materials research

Neutrons are versatile and are ideal for investigating the internal structure and dynamics of matter. They can penetrate deeply into most materials and allow scientists to extract information in a non-destructive manner. Companies from a number of industry sectors have already successfully used ILL's facilities for product research, analysis and development.

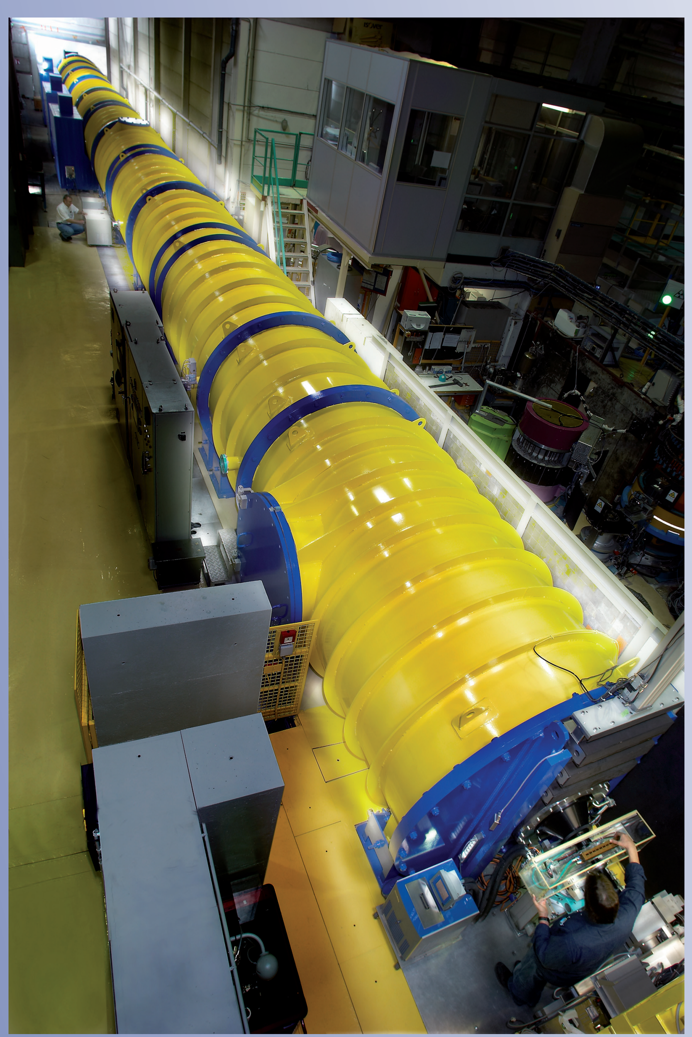


Strain imagers for engineering applications

SALSA is ILL's strain imager, dedicated to the determination of residual stresses in a broad range of components and materials. It is designed for diffraction measurements in 'real' engineering components and optimised for stress determination in metallic components. Its use include validating and optimising numerical models and verifying the design of critical components.

Friction stir welding

Friction stir welding (FSW) is a solid-state welding process.
The joining of similar materials (mainly Al alloys) by FSW is becoming widely implemented in industrial production. FSW of dissimilar materials has been characterised using a non-destructive strain and phase-mapping technique developed at ESRF and ILL, leading to a better analysis of residual stress distribution in the joined materials.



Small angle neutron scattering

Small angle neutron scattering (SANS) is a neutron technique for investigating objects and structures on a typical length scale ranging from 1 to 1000 nm. Taking advantage of the neutrons sensitivity to nuclear isotopes and nuclear spin, valuable information on the size, shape and orientation of nano-scaled materials can be obtained from the interaction between neutrons and the sample's nuclei at small angles (elastic scattering). The technique is complementary to small angle X-ray and light scattering but is particularly interesting for studying hydrogen-rich soft condensed matter and biological structures by enhancing the scattering contrast through chemical isotopic substitution of hydrogen for deuterium.

Flow improvers

Our quality of life depends among other things on maintaining the transportation of people and goods, even under harsh climatic conditions.

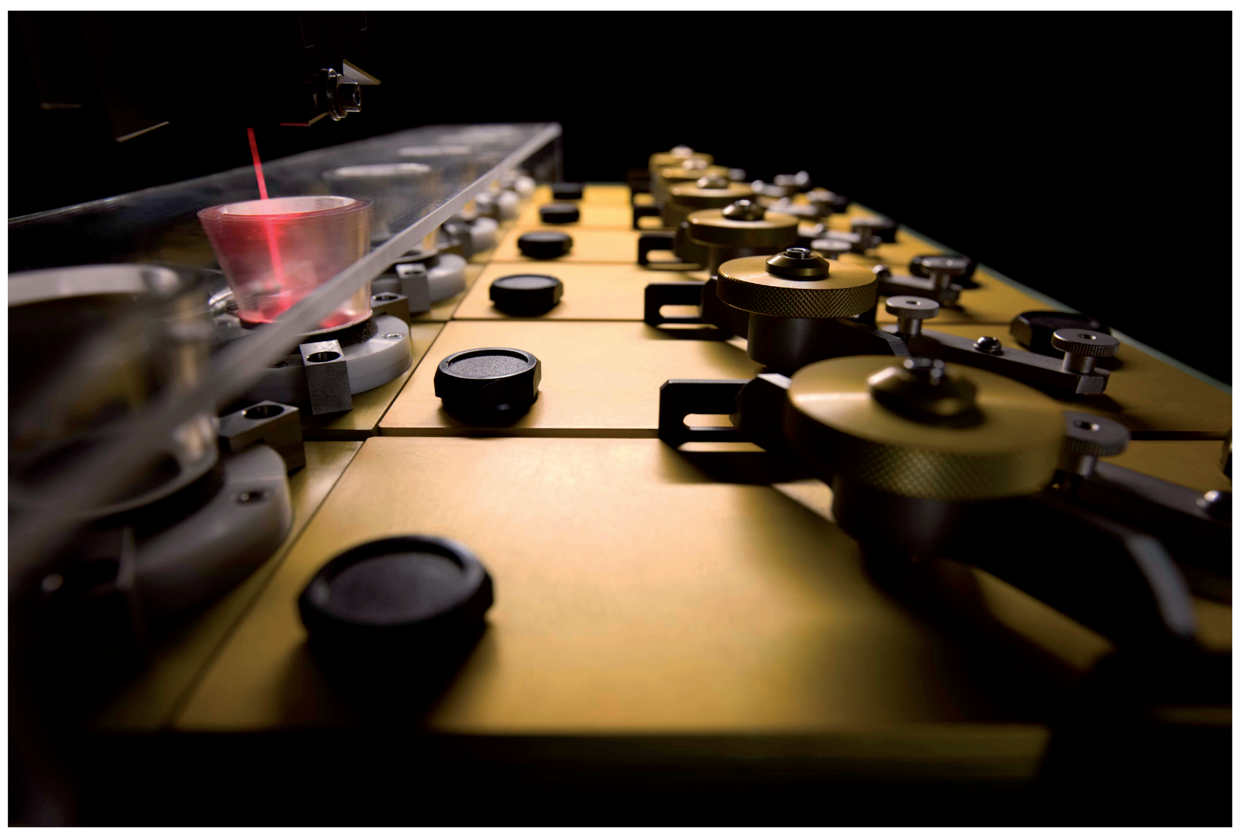
A well-known problem at low temperatures is the growth of wax crystals, which block diesel fuel filters and cause engine stoppage. Modern diesel fuels contain block-copolymer additives (mid-distillate flow improvers) which significantly reduce crystal size and allow vehicles to operate in low temperatures. Results obtained with small angle neutron scattering suggest that the supramolecular structure formed by self-assembly of the additives interacts with the alkanes to control crystallisation in diesel fuel.

Neutron reflectometry (NR)

Neutron reflectometry is a technique which can probe the structure and composition of materials at surfaces and interfaces on a typical length scale ranging from 1 to 1000 nm. Isotopic substitution is a key part of most measurements, as the sensitivity of the measurement to particular components can be enhanced enourmously.

On the new reflectometers **FIGARO** (liquid) and **D17** (solid), combinations of fundamental and applied science are possible on polymers and surfactants (formulations such as shampoos and conditioners), lipids and proteins (lung surfactants and thearpies), DNA (drug and gene delivery), nanoparticles drugs and formulations) and atmospheric surfactants (environmental research).

Questions concerning the mechanisms and timescales of processes which occur at surfaces can be answered, and individual active components in complex mixtures can be monitored in turn.



european photon & neutron science campus

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NEUTRONS FOR SCIENCE