Synchrotron x-ray experiments in the world's strongest magnetic field

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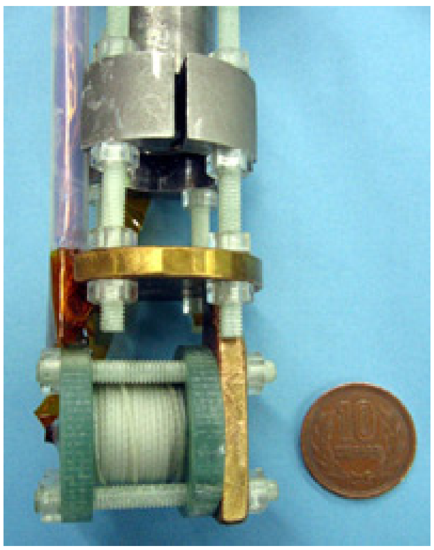

Figure 1. A miniature pulsed magnet attached to the sample-rod of a helium cryostat. The magnet is cooled down to helium temperature together with a sample. This magnet is a solenoid type coil wound by AgCu wire; the outer part is reinforced by grass fibers. A Japanese 10 yen coin is on the right hand side of the magnet as a scale. (Courtesy: SPring-8)

A combination of high magnetic fields and "quantum beam" such as synchrotron x-rays or neutrons is one of most powerful experimental means to examine the magnetic and the electronic properties of strongly correlated electron systems and of functional materials for spintronics applications.

Recently, a team of Japanese researchers have succeeded in performing the high magnetic field synchrotron x-ray experiments up to 51 Tesla at the BL22XU beamline of SPring-8 (Fig 2).

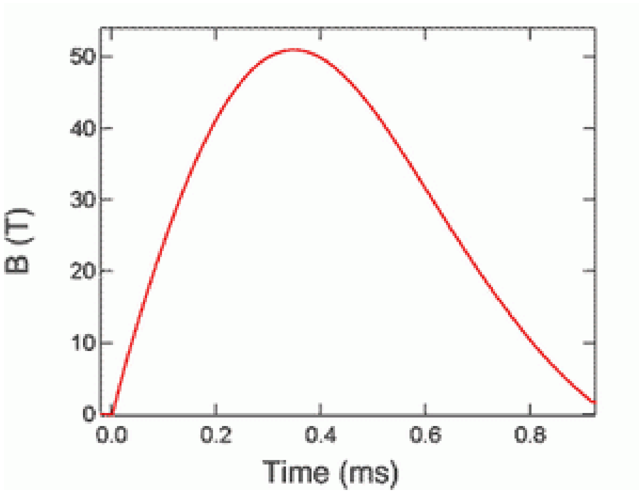

Figure 2. A wave form of pulsed magnetic field generated by the mini-magnet. The high field up to 51 T is generated and the energy used is around 1.4 kJ. (Courtesy: SPring-8)

It is the world's strongest magnetic field used for the quantum beam experiment. As the first series of experiments, the field-induced valance transitions in rare-earth inter-metallic compounds have been studied by means of x-ray absorption spectra and x-ray diffraction.

The key of this achievement is the use of the miniature pulsed-magnet (Fig 1). The volume and the energy of the present magnet are as small as 1 % of those of conventional pulsed magnet.

Moreover, the miniature pulsed-magnet is readily installed into the standard cryogenic system of a conventional diffractometer. This feature enables us to perform such high field experiments rather easily. The present achievements will open a variety of new applications in x-ray scattering and x-ray spectroscopy in extremely strong magnetic fields.

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Source: SPring-8