

20 T/m high field gradient strength diffusion measurement system

Product used : Nuclear Magnetic Resonance (NMR)



Diffusion probe



50A Bipolar magnetic field gradient power supply

Specification	
Maximum magnetic field gradient	12T/m @ 30A 20T/m @ 50A
Sample tube diameter	5 mm
Available Nuclei	^1H , ^{19}F , (^{31}P), ^7Li , ^{11}B to ^{17}O , ^{15}N
NMR lock	^2H
FG polarization	Bipolar
VT range	-70 to 120 °C
Auto Tune	Available

* Some of observable nuclei are subject to change

The new generation diffusion probe is specially designed for diffusion applications that requires a large magnetic field gradient. By improving the design around the coil, the recovery time after field gradient pulse has been significantly shortened compared to the conventional model. Using a newly developed 50A bipolar magnetic field gradient power supply, a magnetic field gradient of 20 T/m (2000 G/cm) can be applied, making it possible to measure diffusion coefficients on the order of 10^{-14} m²/s. This system is ideal for measuring the diffusion of ions in solid electrolytes.

Diffusion measurement of Lithium ions in solid electrolyte

Since the ^7Li signal of lithium ions in solid electrolyte often has a short T_2 relaxation time, the magnetic field gradient pulse (PFG) width applied to the transverse magnetization cannot be sufficiently long. Since the diffusion coefficients of solid electrolytes are also small, it is necessary to be able to apply a large amplitude of PFG in a short time in order to obtain attenuation of the echo signal due to diffusion.

Fig. 1 shows ^7Li echo signal decay plots of solid oxide electrolyte LLTZO ($D=2.1 \times 10^{-13}$ m²/s @30°C) using 30A (12 T/m) and 50A (20 T/m) magnetic field gradient power supplies. The use of the 50A power supply makes it possible to calculate the diffusion coefficient more accurately and to measure the diffusion of systems with smaller diffusion coefficients.

Sample: LLTZO single crystal
 Instruments: JNM-ECZ500R, Diffusion probe
 Method: ^7Li Stimulated Echo
 Diffusion time = 150 ms
 PFG width = 2.5 ms
 Temperature = 30 °C

Courtesy of Dr. Naoaki Kuwata (NIMS)
 and Dr. Junji Akimoto (AIST)

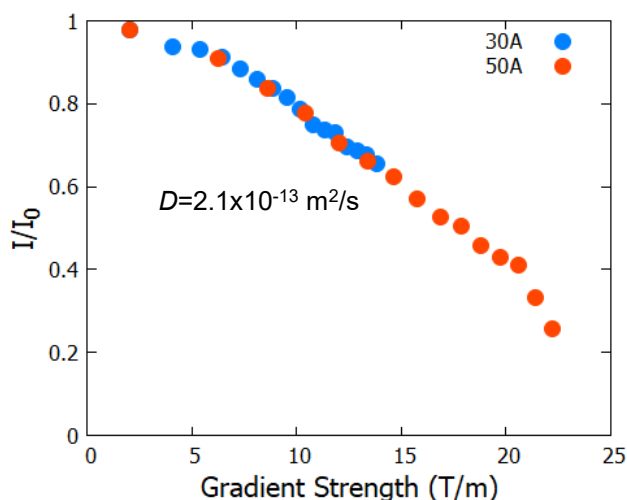


Fig. 1 ^7Li signal decay plots of a single crystal LLTZO as a function of gradient strength by using 30A and 50A gradient power supplies.

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