

# Study the dynamic of a vanadium doped $\text{LiFePO}_4$ lithium ion battery using by quasi-elastic neutron scattering technique

Chih-Wei Hu(胡芝璋)<sup>a,b</sup>, Chih-Hao Lee(李志浩)<sup>a,b,\*</sup>, Pin-Jiun Wu(吳品鈞)<sup>b</sup>,

*a Department of Engineering and System Science, National Tsing Hua University, Hsinchu 30013, Taiwan*

*b National Synchrotron Radiation Research Center, Hsinchu, 30076, Taiwan*

The quasi-elastic neutron scattering (QENS) studies of lithium-ion ( $\text{Li}^+$ ) diffusion in lithium iron phosphate with vanadium additives ( ${}^7\text{LFPV}$ ) are presented. The QENS signals of  $\text{Li}^+$  for  ${}^7\text{LFPV}$  were collected using the backscattering neutron spectrometer at FRM II with the energy resolution of  $0.3 \mu\text{eV}$ . From the QENS result, the self-diffusion coefficient  $D^{\text{Li}}$  was estimated as  $\sim 10^{-11} \text{ cm}^2/\text{s}$  with jump diffusion model at  $T = 600 \text{ K}$ . This result is faster than the reports using electrochemical impedance spectroscopy, galvanostatic intermittent titration technique and cyclic voltammetry measurement, but slower than the molecular dynamic simulation. It could be due to the grain boundary impedes the transport of  $\text{Li}$  ion, which is not considered in molecular dynamic simulation and QENS experiment.