Neutron Study on Li₃PO₄ Solid Electrolyte Prepared by Wet Chemical Reaction

E.Kartini¹, T.Y.S. Putra¹, Supardi¹, W.Honggowranto¹, T.Umbar², M.Manawan³

¹Science and Technology Center for Advanced Materials, National Nuclear Energy Agency (BATAN), Kawasan Puspiptek Serpong, Tangerang Selatan 15314, Indonesia.
²Technochemical Engineering, Polytechnic Institute of Nuclear Technology (STTN), Jl.Babarsari, Yogyakarta, Indonesia
³Postgraduate Program of Materials Science, Faculty of Mathematic and Natural Science, University Indonesia, Jl. Salemba Raya No.4, Jakarta 10430, Indonesia

Abstract

Safety is the main problem on developing the lithium ion battery. The combustion is mainly due to the leakage or shortcut of the electrodes, caused by the liquid electrolyte and polymer separator [1]. For this reason, the research on solid electrolyte for replacing the existing liquid electrolyte is very important. Li₃PO₄ has been proved to be a good candidate for solid electrolyte, due to its easy in preparation, low cost, high melting temperature and good compatibility with the electrode materials. So far, Li₃PO₄ has been applied in thin film battery [2]. In the present work, Li₃PO₄ has been prepared by wet chemical reaction, a simple method with the advantage of recycling a waste product H₃PO₄. The crystal structure of Li₃PO₄ has been measured by using high resolution powder diffraction (HRPD) at the Neutron Scattering Laboratory, National Nuclear Energy Agency (BATAN), Indonesia. In addition, the x-ray diffraction was also carried out to the same sample, besides several measurements on its thermal and electrical properties [3]. The neutron results show the crystal structure of orthorhombic phase Pmn2₁ (31), that belongs to the β-Li₃PO₄ [4], with the lattice parameters are a = 6.116819, b = 5.249803, c = 4.872359. The conductivity of β-Li₃PO₄ was around 10⁻⁸ S/cm, and no phase transition β-to γ-Li₃PO₄ was detected on heating the materials up to 900°C.

Keywords: Neutron diffraction, solid electrolyte, Li₃PO₄, lithium ion battery.

References