Korean HANARO facility and it's applications in polymer science

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HANARO (High-flux Advanced Neutron Application Reactor) was designed and constructed by Korea Atomic Energy Research Institute (KAERI); its construction was completed in April 1995. Thereafter, seven beamlines were constructed: (1) small angle neutron scattering, (2) neutron radiography, (3) high resolution powder diffraction, (4) four circle diffractometry, (5) residual stress, (6) polarized neutron spectrometry, and reflectometry. This research facility will be introduced briefly, including its future plans. In addition, as an application example of this HANARO research facility, neutron scattering studies on the miscibility and structure of polyolefin blends is presented here.

Blends of polyethylene and its copolymer such as low density polyethylene (LDPE) and linear low density polyethylene (LLDPE) have attained widespread commercial applications to obtain the intermediate physical properties, though the understanding of the mechanical and melt-flow properties of such blends has hitherto been handicapped by the absence of a consensus concerning the degree of mixing of the components, in both the melts and solid states. Neutron scattering has been used for determining the melt compatibility of blends. Up to the presents, there are many available SANS results for blends of high density polyethylene (HDPE) and other copolymers. Such studies are focused on the effect of isotope substitution, branch content, molecular weight on the melt miscibility and crystallization rate on the cocrystallization behavior and so on. When the branch contents were increased, there was phase segregation in blends of linear and branched chain in the melt state. It has been explained as the branch causes the additional repulsive interaction. Then, one can have a question: if linear chain is exchanged with one having other type of branch, then, what will be happen. Both different branches will contribute to increase the interaction parameter, then, will the phase segregation be occurred?

In order to get answer about this question, using neutron scattering we investigated blends of LDPE and LLDPE. Here, LLDPE is a counterpart of HDPE, where backbone is the same as the linear chain but has *n*-octene branches. Both in the melt and quenched state, we will discuss the miscibility of two components and the size of chain. In particular, the distribution of the hydrogenated and deuterated chain stems in the crystalline lattice is also included in the discussion.