

Neutron beam applications for stress and deformation research in engineering materials

Wanchuck Woo¹

¹*Korea Atomic Energy Research Institute, Korea*

E-mail: chuckwoo@kaeri.re.kr

Neutron beam produced by research reactors has been widely utilized for the researches on industrial applications. Since neutron diffraction has become a unique tool for the understanding of the physical and mechanical properties in various engineering materials, here we present recent research activities using an engineering neutron diffractometer at Korea research reactor called HANARO. Examples include (i) determination of residual stresses through the thickness of extra thick welds and (ii) stress-strain relationship between ferrite and martensite phases in a dual-phase high-strength steel. Firstly, the proper selection of a long wavelength (2.4 Å) having a low neutron cross-section and the usage of the focusing bent monochromator significantly enhanced the penetration capability of neutrons up to the total path of 85 mm with ± 100 μm strain error. It results in a first through-thickness stress distribution in 70 mm thick welds. Secondly, deformation behavior of each ferrite and martensite phase was investigated under loading in a dual phase steel. Although there is a difficulty in separating the two peaks because of the similar crystal structures (bcc and bct), the asymmetric peak broadening enables us to separate the individual peak of the two phases due to the difference in diffraction elastic modulus.