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## Interface structure of epoxy adhesive studied by neutron reflectometry

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Epoxy resins have been widely used as adhesives in various fields. However, the fundamental factors to determine the adhesion performance have been still unclear although adhesion techniques are actively developed from the practical points of view. In this study, neutron reflectometry (NR) with deuterated materials was conducted to elucidate the relationship between the nanometric structure of the adhesion interface and the adhesive strength. For an epoxy adhesive made from bisphenol A diglycidyl ether (DGEBA) and 1,4-bis(aminomethyl) cyclohexane (CBMA), the neutron scattering length density (SLD) profile at the adhesion interface was characterized in a humid atmosphere of heavy water, showing a large increase in SLD between the epoxy resin and the substrate. This indicates the formation of a condensed layer of water at the adhesion interface. Whereas the fraction of the water absorbed in the bulk region was only 2-3 %, the fraction at the interface was as large as 40 %. In order to prevent the formation of the water layer at the interface, we developed a multi-step curing process of the epoxy adhesive on the substrate. The structure of the adhesion layer with this process was confirmed by NR measurements using a deuterated DGEBA. As a result, the formation of the water layer was prevented even in a humid environment and the improvement of the adhesion strength.

**Author:** AOKI, Hiroyuki (J-PARC)

**Co-author:** Dr LIU, Yuwei (J-PARC)

**Presenter:** AOKI, Hiroyuki (J-PARC)

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