

## **NEUTRON DIFFRACTION STUDIES ON STRAIN EVALUATION OF REBAR IN REINFORCED CONCRETE**

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It is typical method to measure the strains on a rebar in a reinforced concrete using strain gauges glued on the rebar. The waterproof treatment and wiring of the strain gauges, however, should affect the accuracy of the strain evaluation of the rebar in the reinforced concrete. Therefore, the neutron diffraction technique, which is nondestructive and noncontact technique, might be useful for measuring the strains of the rebar in the concrete accurately. It has been believed that the neutron studies on the concrete are quite difficult due to neutron absorption by the water in hydrated cement paste and the evaporative water in pore spaces. Sufficient dry curing, however, enables the strain measurement of the rebar even in the concrete using neutron diffraction. In this study, we applied the neutron diffraction technique to two kinds of the strain evaluation on the rebar in the reinforced concrete.

At first, the strain behavior on the rebar covered with the concrete blocks, the sizes of  $50 \times 50 \times 150 \text{ mm}^3$  and  $70 \times 70 \times 150 \text{ mm}^3$ , was measured under uni-axial tensile condition. Measured strains in each stress condition well agreed with the stress-strain relation of rebar only. In addition, the stresses on the rebar in the reinforced concrete were measured. The compressive residual stress was generated in the rebar due to drying shrinkage. The share stresses in the rebar were 60% to 80% of the applied stresses, and the stress distribution near the cracks in the concrete were much scattered.

Secondly, the bond strength and the bond region between the rebar and the concrete were evaluated under the pulsating tension using neutron diffraction technique. Stress distributions on the rebar measured using neutron diffraction were different pattern from those measured using strain gauges. In particular, bond region evaluated using neutron diffraction was larger than that evaluated using strain gauges.