Effect of resin injection on bond recovery for damaged reinforced concrete structure

Manabu Kanematsu *(Tokyo University of Science)* Mariko Sekine *(Tokyo University of Science)*
Hiroshi Suzuki *(Japan Atomic Energy Agency)*

1. Introduction

It is currently important to make best use of many existing reinforced concrete (RC) buildings for years by effective maintenance. For instance, rebar corrosion in concrete causes bond degradation between rebar and concrete, resulting in decreasing structural performance of the RC structures. In our previous experiment in 2014A0087, it is found that cracks induced by swelling of corrosion products around rebar degrade the bond stress between rebar and concrete. One of available methods to protect against further corrosion is a resin injection technique, which is widely utilized for RC buildings to repair cracks in concrete structures damaged by earthquakes and aged degradation. This technique can inhibit the intrusion of degradation factors, such as water and oxygen, into concrete from outside by filling resin into cracks. In addition, it is expected to recover from bond degradation between rebar and concrete by filling resin into the cracks, since the resin reaching around rebar would play a role of adhesive between rebar and concrete using BL19 (TAKUMI) in J-PARC MLF..

In this experiment, therefore, the effect of the resin injection technique on the bond condition of RC was evaluated by carrying out the stress measurement using the neutron diffraction technique.

2. Experiment

The RC specimen used in this study is schematically illustrated in Fig. 1(a). A ferritic steel deformed-bar with 9.53 mm in nominal diameter was embedded in a cylindrical concrete with 51 mm in diameter and 460 mm in length. The embedded depth of the rebar was 430 mm, and un-bonded region with 110 mm in length was artificially introduced for determining the reference lattice parameter at this region. The specimen mounted on the tensile frame was set up on the TAKUMI diffractometer, and oriented 45 degrees to the incident beam.

The electrical corrosion method was utilized to provide corrosion on the rebar in concrete. The current with 34.56 Ah in total was applied to the RC specimen for 24 days. Figure 1(b) shows the surface and inside views of specimens subjected to the corrosion test. Large splitting cracks induced by swelling of corrosion products can be observed. The stress distributions were measured under

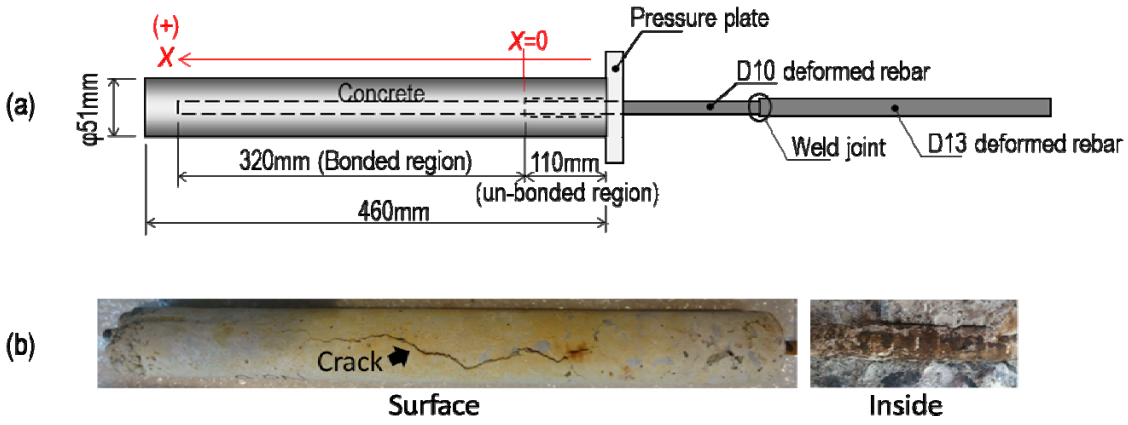

Fig. 1 (a) A schematic illustration of the RC specimen used in this study and (b) the surface view of the specimen and inside view of the another specimen with the same treatment.

pull-out loading before and after repairing cracks by the epoxy resin injection.

3. Results

Figure 2 shows the axial stress distributions along rebar in the RC specimen subjected to the corrosion test before and after repairing cracks by the epoxy resin injection. The stress distribution before repairing was measured about three years ago in 2014A0087. The stress distribution in the region from X=50 mm to 250 mm exhibits small gradient due to bond degradation around the spitting cracks. After repairing by epoxy resin injection to cracks, the axial stresses decrease rapidly along rebar toward X=150 mm, showing recovering of bond resistance between rebar and concrete.

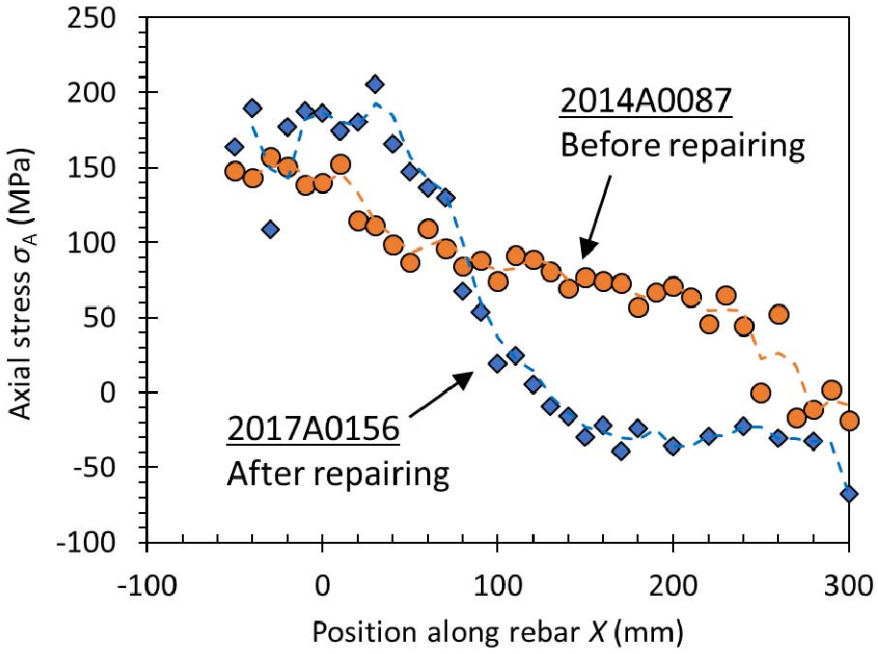

Fig. 2 Axial stress distributions before and after repairing measured by neutron diffraction.

4. Conclusion

In this experiment, the stress measurements of the RC specimen subjected to a corrosion test were measured by neutron diffraction before and after repairing cracks by the epoxy resin injection. As a result, it was found that bond resistance between rebar and concrete can be recovered from bond degradation due to rebar corrosion by repairing cracks. The resin injection repairing technique can inhibit the intrusion of degradation factors as well as this can play a role of making recovery from bond degradation between rebar and concrete by filling resin into the cracks.

In relevant experiment performed in 2017A0157, filling state of resin in cracks in the same RC specimen was observed by use of neutron imaging technique. The recovering mechanism of bond resistance will be discussed by comparing the direct inside image of the RC specimen with the stress distribution measured in the current experiment.