



The effect of geo-materials on the autogenous healing behavior of cracked concrete

[Introduction]

The serviceability and durability of concrete structures has been extensively studied by various researchers. The serviceability limit of concrete structures is primarily governed by the extent of damage. Cracks, one of various types of damage, play an important role in the serviceability limit. However, if it were possible to know the reason for differing behavior of concrete structures exposed to largely similar conditions, we might have the key for designing high-durability structures with low or negligible maintenance and repair costs. Furthermore, the serviceability limit of concrete structures by cracking might be overcome by crack control methodologies; this enhanced service life of concrete structures would reduce the demand for crack maintenance and repair. The aim of this study is to develop autogenous healing concrete using geo-materials for practical industrial application. Research has been done on the healing of cracks in aged concrete.

This study has focused on two primary issues: (1) experimental and analytical design of cementitious materials with self-healing capabilities, (2) development of a self-healing concrete using new cementitious materials at normal water/binder ratio [over $W/B=0.45$]

[Results & Discussion]

Figure 2 shows the re-hydration products on the surface of the specimen between the original and self-healing zones. Figure 2 (b) shows the X-ray map and spectra taken from rehydration products. It was found that the re-hydration products were mainly composed of high alumina silicate materials as shown in the X-ray mapping results.

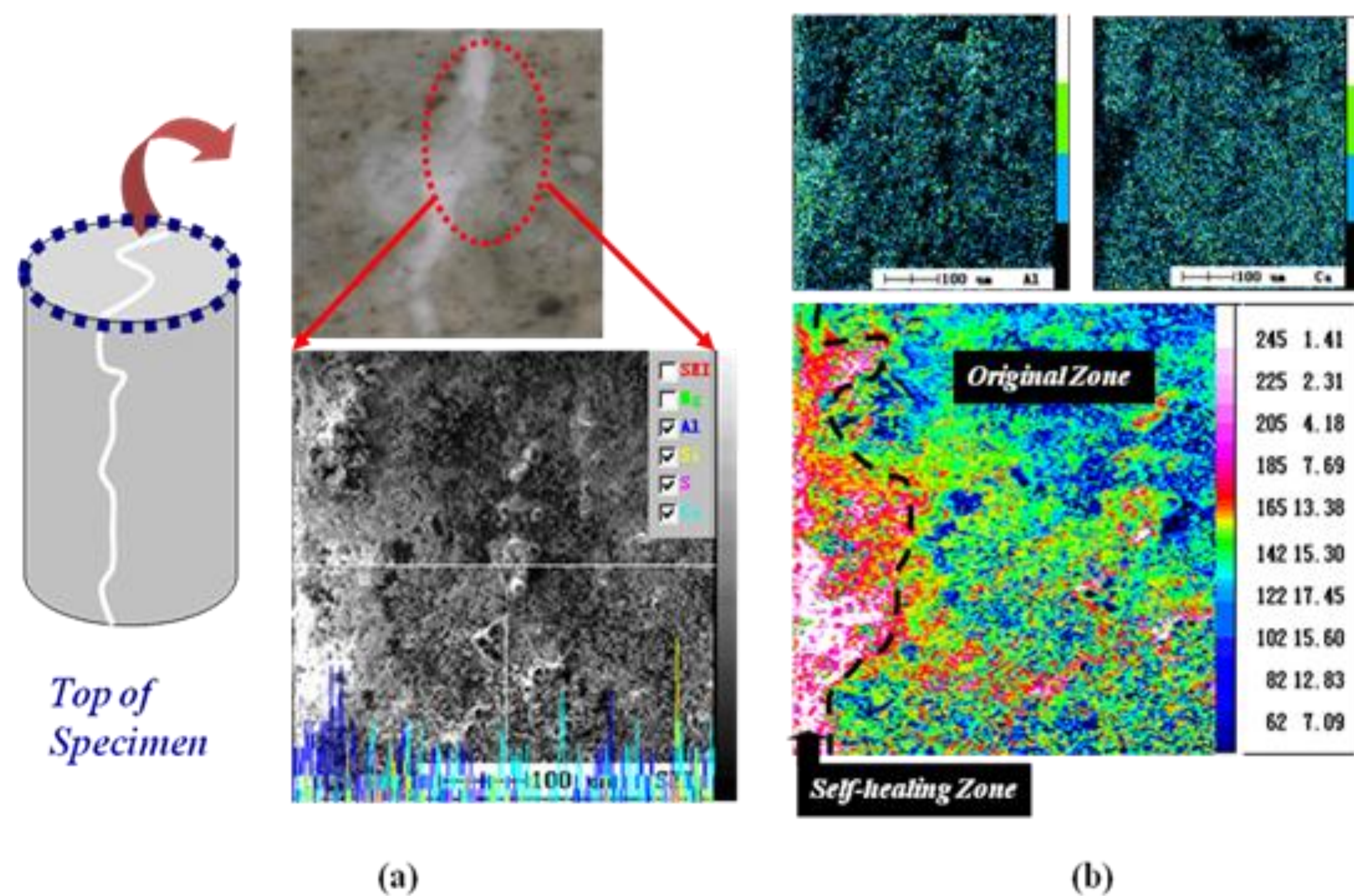


Figure 2. Self-healing phenomenon of crack by crystallization of aluminosilicate phases on the cementitious pastes incorporating CSA and Geo-materials [Surface Analysis of specimen]

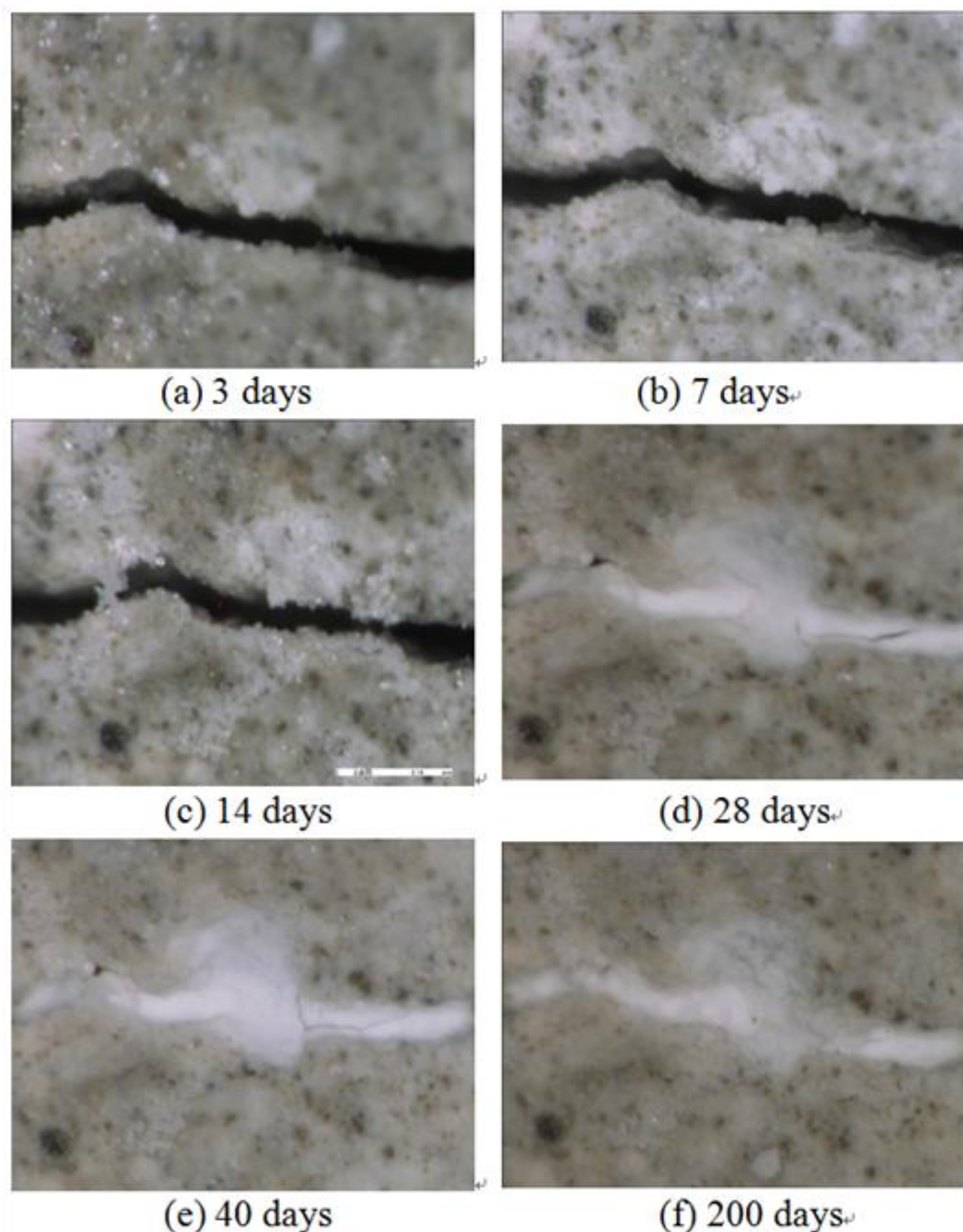


Figure 1. Process of Self-healing on [OPC90%+CSA5%+Geo-materials5%] pastes at normal water/binder ratio of 0.45 (the three-component system)

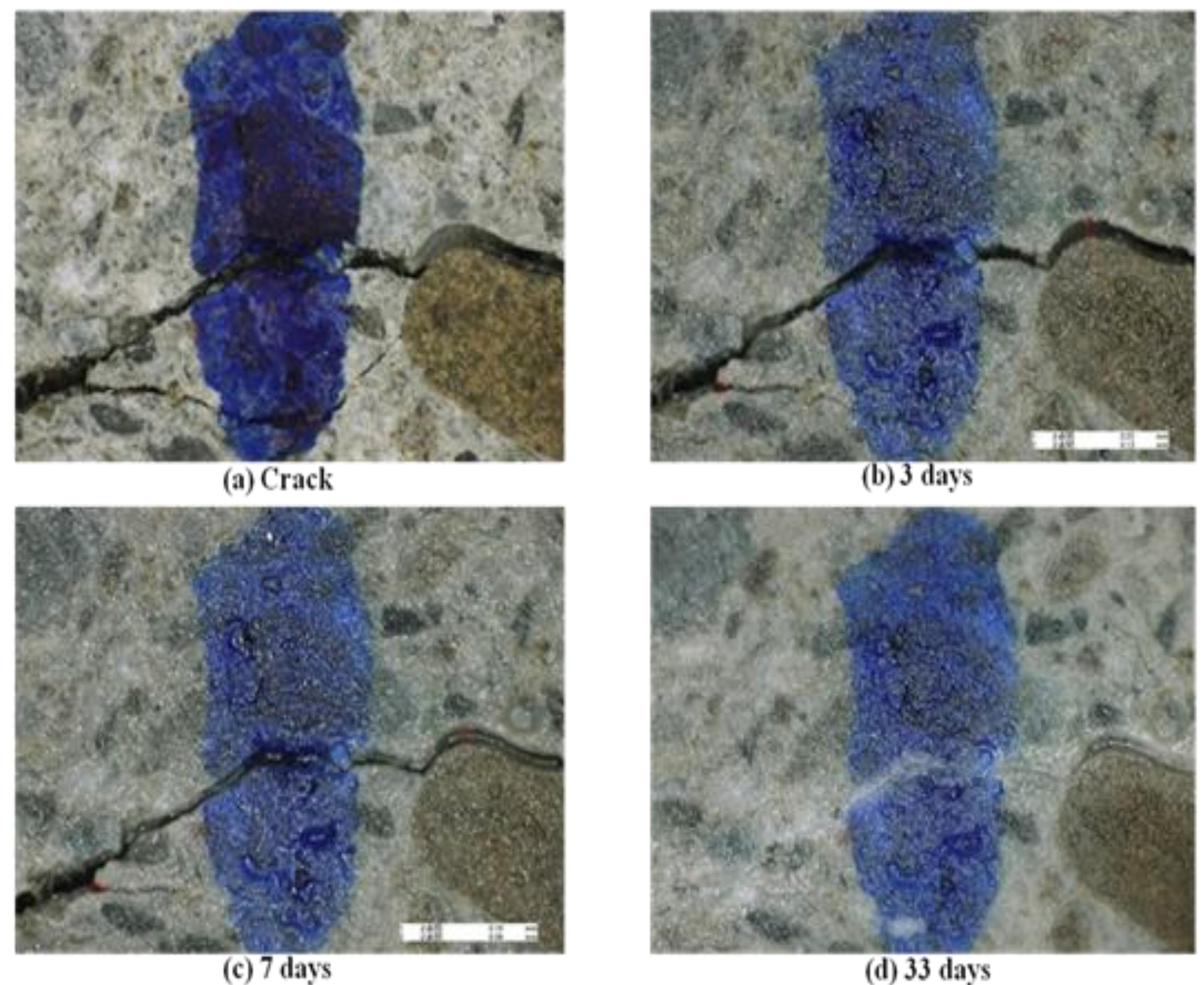


Figure 3. Process of self-healing on self-healing concrete at water/binder ratio of 0.47

[Conclusion]

In this study, the self-healing properties of concrete using geo-materials were investigated.

1. Self-healing capability was significantly affected by aluminosilicate materials and various modified calcium composite materials.
2. The essential properties such as swelling and re-crystallization of geo-materials with pozzolanic reaction for self-healing were analyzed and discussed.