Study on the effects of chemical weathering of black shale on the concrete

*Xin Liao[1], Qingfeng Wang[1], Jian Li[2], Xiyong Wu[1,3], Jiannan Chen[1]

1. Faculty of Geoscience and Environmental Engineering, Southwest Jiaotong University, Chengdu City, China, 2. College of Civil Engineering, Chongqing Jiaotong University, Chongqing city, China, 3. MOE Key Laboratory of High-Speed Railway Engineering, Southwest Jiaotong University, Chengdu city, China

The black shales containing sulfide minerals such as pyrite are prone to acidify environment water during chemical weathering in oxidizing condition. The acid environmental solution is characterized with rich in iron and sulfate ions. When engineering constructions are built in black shale areas, concrete as the common engineering material will inevitably interact with the acidic water produced by the chemical weathering of black shale. This paper summarizes the results of immersion experiments intended to investigate the rock-water-concrete interactions at different immersion height. Electrical conductivity (EC) and pH values of the solution were monitored at intervals. Concentrations of major ion species were determined for solutions collected in the end of the experiment. Micro-fissure development within the rock and concrete samples was determined by ultrasonic tester before and after experiment. Mineral and strength analysis were conducted with X-ray diffraction and uniaxial compressive strength apparatus. The results indicate that 1) chemical reaction of black shale mainly occurred in the upper part of rock above the water, and capillary action was significant for the water-solid interactions for black shale and concrete; 2) the immersion solution caused corrosion in the surface of black shale and concrete, which dramatically reduced the compressive strength of black shale but increased that of concrete slightly in the immersion period. This change can be attributed to the products formed by the chemical reaction between sulfate-rich ion solution and concrete filled in voids and micro-fissures.

Keywords: Black shale, Concrete, Water-rock interaction, Chemical weathering

