

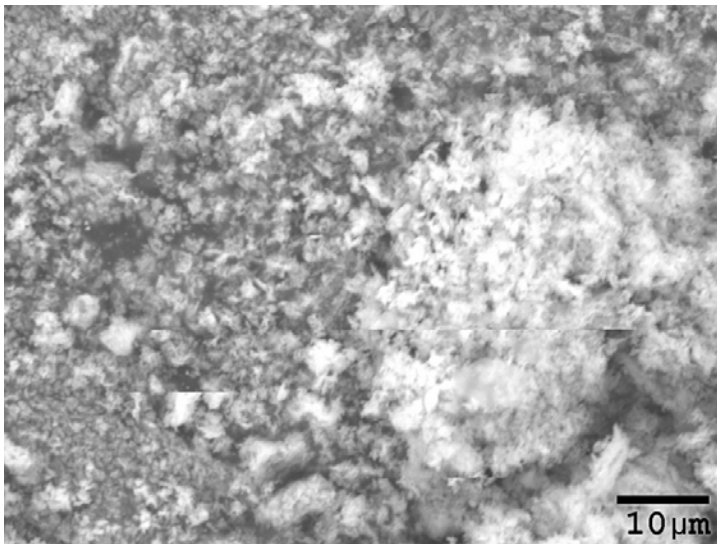
Tech Center
March/April
2003

Case study: Efflorescence

By Mark Lukkarila, SPEC MIX Technical Services Manager

The materials used in the building of masonry walls contain soluble salts of various compositions. The soluble salts go into solution when water is available and are subsequently transported to the mortar, brick or block surfaces where evaporation causes the salts to form a deposit called efflorescence. In new building construction, some efflorescence due to lime or calcium hydroxide is common. Other soluble salts are present in clay brick. Soluble salts in brick can include vanadium, manganese, sulfate, barium and chromium compounds. Soluble salts potentially contributed from mortar and block can include calcium hydroxide, carbonates, sulfates and chlorides.

For example, a new car dealership was constructed recently in Las Vegas, Nev. The masonry wall system was composed of colored concrete masonry units and colored mortar (both dark gray). Shortly after the masonry walls were constructed, efflorescence began appearing on the mortar joints and concrete masonry units. A majority of the mortar and concrete masonry units exhibited white efflorescence. The contractor assumed that the efflorescence was caused by the lime from the mortar. Samples of efflorescence material were collected and analyzed at the SPEC MIX®, Inc., laboratory.



SEM image of the white efflorescence material.

The samples were viewed using a low vacuum scanning electron microscope with energy dispersive spectral (EDS) analysis of X-rays capability. The analysis revealed that the efflorescence was not caused by the lime used in the mortar. The crystal morphology and chemical composition of the efflorescence material and chemical composition were consistent with sodium sulfate (i.e., Thenardite).

Sodium sulfate is a soluble salt typically associated with sulfate-bearing soils or ground water and is common in the southwestern region of the United States. Potential sources for the alkali sulfate efflorescence in new construction can include, but are not limited to:

- Storing of concrete masonry units on the ground;
- Water used in the making of mortar, masonry units or grout;
- Unwashed sands used in the masonry units, grout or mortar.

Different compositions require different removal procedures. While specific proprietary cleaners are effective for calcium hydroxide-related efflorescence, they may not be effective on alkali sulfates. An effective method of removing sodium sulfate efflorescence is to scrub with a dry, stiff brush. If necessary, water can be used with the brush to remove the efflorescence. Since the alkali sulfate is water-soluble, prolonged exposure to precipitation may also mitigate the efflorescence. Efflorescence may reoccur as long as there is availability of the alkali sulfate and moisture.