

Decomposition of Asbestos at Room Temperature by Using Calcium Polysulfide

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Asbestos is a light material and superior in insulation, it had been widely used in roof and pipe of hot water for insulation. However the use and the import of asbestos were stopped and prohibited because of its toxicity causing cancer. Therefore safety decomposition of construction material containing asbestos is required. Normally asbestos is fused at 1500 °C, but its cost is expensive. We found that the asbestos fibers were decomposed to less than 0.1 % in content after mixing of the asbestos with calcium polysulfide (CaS_x) solution in a rotating reaction vessel with ceramic or iron balls for 20 hours at ambient temperature. The decomposition of asbestos was confirmed by a phase contrast microscope, an X-ray diffraction (XRD) and a scanning electron microscope (SEM).

SEM indicates the asbestos fiber shows sharp needle crystal, but that the needle crystal disappears and changes to a lump after the treatment (Fig. 1). XRD measurement also supports complete the disappearance of the specific peaks of asbestos fibers after the treatment and the production of sulfur, calcium sulfite and calcium sulfate, which were confirmed by X-ray absorption near edge structure (XANES) spectra of sulfur. XANES spectra of the treated asbestos indicated gradual oxidation of sulfide to sulfate (S²⁻ → S → SO₃²⁻ → SO₄²⁻) during the treatment.

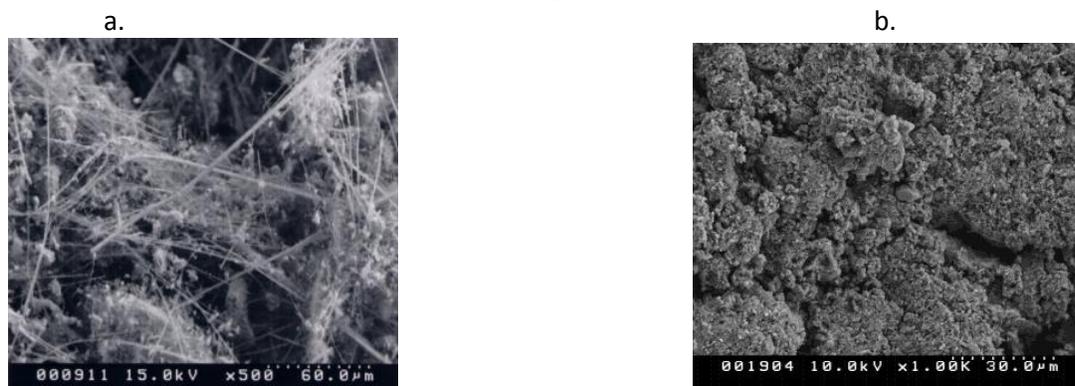


Fig. 1. SEM pictures of asbestos before (a) and after (b) the treatment.

Calcium polysulfide penetrates into a crystal lattice space of asbestos fibers and is oxidized to sulfur and sulfates that decompose asbestos fiber like the rock decomposition by weather because the ionic radius of SO₄²⁻ is large (2.44 Å).

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