Thermal decomposition and mineralogical changes of chrysotile fibers

HYEONYI JEONG[1], JIEUN LIM[2], WONJIN MOON[2] AND YUL ROH[1*]

[1]Chonnam National University, Gwangju, Korea, ([*]correspondence : rohy@jnu.ac.kr)

[2]Korea Basic Science Institute, Gwangju Center, Korea

The use of chrysotile [$Mg_3Si_2O_5(OH)_4$] asbestos has been banned in many countries because of its carcinogenecity. Waste disposal of used chrysotile and health problem by its exposure are being issued and suggested to study detoxyfication processes of chrysotile fibers. The objective of this study was to investigate changes of mineralogical characteristics of chrysotile fibers by thermal decomposition.

Chrysotile sample was collected from LAB Chrysotile mine, Canada. The decomposition of chrysotile fibers heated in air has been studied in the range of 600 to 1300℃. The changes of mineralogical characteristics including crystal structure, shape, and chemical composition of the chrysotile fibers were examined by TG-DTA, XRD, FT-IR, SEM-EDS and TEM-EDS analyses.

The chrysotile fibers were dehyroxylated at 630℃. And the chrysotile was transformed to forsterite (Mg_2SiO_4) at 820℃ by rearrangement of Mg, Si, O. Forsterite were transformed gradually to enstatite ($MgSiO_3$) by recrystallization after the heating above 1100℃. Fibrous form and hollow tube structure of chrysotile fibers were started to collapse above 700℃ and transformed to rod-shaped forsterite at 820℃. And enstatite was grown 3-dimensionally within the forsterite crystal structure, and then finally transformed to spherical minerals above 1100℃.

In summary, detoxification of chrysotile asbestos by thermal decomposition may be applicable at lower temperature at 700℃ than 820℃ reported in previous studies. And thermal decomposition can be used to detoxify chrysotile fibers because chrysotile fibers were entirely transformed to non-hazardous minerals.