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Chemical reactivity of thermal treated naturally occurring amphibole asbestos

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Non-occupational (environmental) exposure to naturally occurring asbestos (NOA) represents a potentially important source of risk for human health in several parts of the world. Chemical reactivity of fibres surface is one of the most relevant physical-chemical property to asbestos toxicity and is commonly associated to the presence of Fe at the surface, and in particular to its coordination and oxidation state. However, no detailed information is still available about dependence of chemical reactivity on surface iron topochemistry, which is the basis for defining structure-activity relationships. In this work the chemical reactivity of two amphibole asbestos samples, UICC crocidolite from Koegas Mine, Northern Cape (South Africa) and fibrous tremolite from Montgomery County, Maryland (USA), was investigated after sample heating up to 1200 °C. Ex-situ X-ray powder diffraction (XRPS and the Rietveld method), scanning (SEM) and transmission (TEM) electron microscopy were used for characterizing the mineral fibres before and after the thermal treatment. In addition, thermal stability of the of the amphibole asbestos was analysed in-situ by TG/DSC. Two conventional target molecules (H_2O_2 and $HCOO^-$) and the DMPO spin-trapping/EPR technique were used to measure the radical activity of both pristine and thermal treated samples. Results show that, after thermal treatment, both amphibole asbestos are completely converted into hematite, cristobalite and pyroxene, still preserving the original fibrous morphology (pseudomorphosis). Notably, in spite of the thermal decomposition, the heated samples show a radical production comparable to that of the pristine ones.

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