Revealing the lifelong bio-persistent crystal structure of an asbestos fibre

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Humans have used asbestos for about 5,000 years in various parts of the world [1] because of its outstanding properties. The massive use of asbestos turned out to be a global environmental problem when animal carcinogenicity tests and long-term epidemiological studies proved that inhalation of asbestos fibres may induce fatal lung diseases like asbestosis, carcinoma, malignant mesothelioma (MM) and many more after a latency period of decades [2].

Besides the morphological and chemical characterization conveyed by ESD-supported electron microscopy, X-ray diffraction is considered a reliable tool for the characterization of asbestos fibres. Due to problems of peak overlap in powder data, it is not possible though, to carry out a free refinement of these complex atomic structures in order to detect and measure subtle chemical changes to prove the biopersistence.

Since 2016, ID11 offered a new end station, called "nanoscope" where it is possible to focus the beam to the deep sub-micron scale. This is possible by using the in-line crossed silicon compound refractive lenses [3] and using a crossed pair of vertical and horizontal line foci. Combining the very small beam size with a diffractometer to align and maintain a sample in the beam during rotation is very promising for the crystallographic characterization of natural fibres. Here we report a proof of the in vivo biopersistence of asbestos fibres in human lung tissues (**figure1**) at the atomic scale using synchrotron micro-diffraction. We show that the atomic structure of an amosite fibre remained stable for about 40 years in the lungs of a subject diagnosed with malignant mesothelioma (MM) and originally exposed to a mixture of chrysotile, amosite and crocidolite [4].

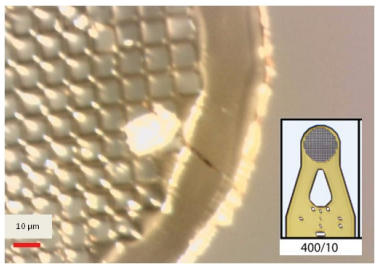

Figure 1. The amosite fibre extracted from the lung and mounted on a MiTeGen microloops™ of 400 µm diameter and 10 µm mesh size.

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