Combining synchrotron radiation phase-contrast and fluorescence nanotomography to reveal the morphology and elemental composition of biological samples: the case of asbestos bodies

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Imaging techniques exploiting synchrotron radiation have several advantages compared to the same techniques based on conventional X-ray sources. In particular, X-ray phase-contrast and X-ray fluorescence computed tomography (respectively XPC-CT and XRF-CT) can nowadays be operated at resolutions down to few tens of nanometers. Other than the resolving power, an advantage of XPC-CT respect to conventional X-ray absorption tomography is the ability to image law absorbing materials with similar densities, as is the case of biological structures, or to image low and high absorbing materials at the same time, as for example, cartilages and bones. An additional advantage of exploiting synchrotron radiation is the possibility of combining diverse microprobe X-ray techniques in the same experiment to obtain complementary information. In particular, the combination of phase-contrast and fluorescence tomography allows obtaining a more reliable spatially resolved elemental quantification. As an example of the potential of this approach, the case of the asbestos bodies, i.e. the ensemble of asbestos fibers and the ferruginous coating they develop in biological medium, will be discussed.