Correlative light and Helium Ion Microscopy to identify lung response to metal oxide and carbon nanomaterials done on model lung epithelium

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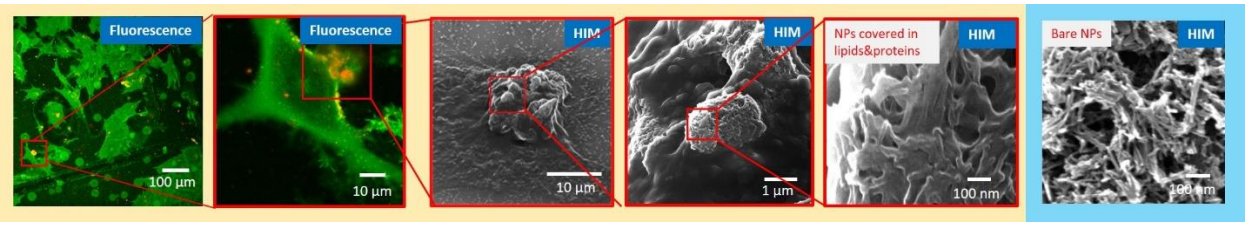
KEY WORDS: correlative microscopy, HIM, nanomaterials, lung epithelium, nanotoxicity

Comprehensive understanding of molecular events governing lung epithelium response to inhaled nanoparticles is still lacking. These repeating events in lungs could eventually lead to persistent inflammation and further cardiovascular diseases [1,2]. To better understand how it all start on a molecular, nanoscale level one urgently needs an appropriate model system and an advanced imaging technique(s) capable of unravelling key information on a nanoscale. Many studies addressing such complex biological problems have been lately tackled by correlative microscopy (CM) approach using an optimal combination of complementary and advanced techniques [3].
Our approach was thus to apply live cell epithelium model imaging using an advanced high-resolution fluorescence microscopy followed by helium ion microscopy (HIM) to visualize structures and morphology further down at nano-scale. One of the HIM advantages to other high-resolution, high-vacuum imaging techniques is large depth of focus, sub-nm resolution, nm surface sensitivity, and especially no need for sample coating that changes the nanostructure morphology on the surface. To gather any further structure-function information of the investigated biological system using such diametrical techniques, an appropriate sample preparation needed to be developed. Once done, we could study sub-micron to nanometer changes that govern model lung epithelium interaction with various nanoparticles. Exposure of metal oxide (TiO2) nanotubes has revealed active passivation of nanomaterial-biological matter composites on the cell surface with lipo-proteins present, identified both with optical and ion beam technique (Figure, below). Findings of CM studies have contributed to better understand chronic inflammation prediction in lung diseases [4]. On the other hand, exposed carbon nanoparticles have shown completely different cell response and will be discussed.



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