

In vivo lung fate and biotransformation of MoS₂ nanosheets

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Among the different 2D nanomaterials and graphene, MoS₂ have received tremendous attention in many fields, including (opto)electronics and nanomedicine [1, 2]. We have recently applied an integrated approach to follow the fate and biotransformation of MoS₂ nanosheets at the nanoscale and their impact on the lung inflammation status over one month after a single inhalation in mice. The analysis of the immune cells, the alveolar macrophages, the extracellular vesicles, and the cytokine profile showed that MoS₂ nanosheets can induce an initial phase of lung inflammation that is rapidly resolved despite the persistence of various biotransformed molybdenum-containing nanostructures in alveolar macrophages and extracellular vesicles up to one month (Figure 1). Using *in situ* liquid phase transmission electron microscopy, we evidenced the dynamics of MoS₂ nanosheet transformation triggered by reactive oxygen species. Three main alteration mechanisms were observed: 1) scrolling of the dispersed sheets leading to the formation of nanoscrolls and folded patches, 2) etching releasing soluble MoO₄⁻, and 3) oxidation generating oxidized sheet fragments. Extracellular vesicles were also identified as a potential shuttle of MoS₂ nanostructures and their degradation products and more importantly as mediators of inflammation resolution [3].

References

- [1] Kurapati, R.; Prato, M.; Kostarelos, K.; Bianco, A. *Advanced Materials*, 28 (2016) 6052-6074.
- [2] Kurapati, R.; Muzi, L.; Perez Ruiz de Garibay, A.; Russier, J.; Voiry, D.; Vacchi, I. A.; Chhowalla, M.; Bianco, A. *Advanced Functional Materials*, 27 (2017) 1605176.
- [3] Ortiz Peña, N.; Cherukula, K.; Even, B.; Ji, D.-K.; Razafindrakoto, S.; Peng, S.; Silva, A. K. A.; Ménard Moyon, C.; Hillaireau, H.; Bianco, A.; Fattal, E.; Alloyeau, D.; Gazeau, F. *Advanced Materials* (2023) doi: 10.1002/adma.202209615.

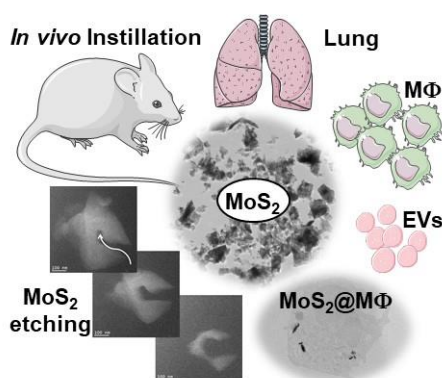


Figure 1: Degradation, fate and impact on lungs of MoS₂ nanosheets.