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Recent Researches on Halloysite Nanotubes a Smart Nanomaterials for Several Applications

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Halloysite clay are aluminosilicate nanomaterials (HNTs) with an unique combination of hollow tubular nanostructure, large aspect ratio, suitable mechanical strength, high perspectives in terms of functionality, biocompatibility ecocompatibility and wide availability.[1] Moreover, their low cost makes them attractive alternative to the better known carbon nanotubes. As a consequence, in the last years, HNTs have garnered particular interest in material science. HNTs possess different inner and outer surface composition; in particular most of the aluminol groups are located in the halloysite inner surface, whereas the external portions are mainly composed of siloxanes providing a surface available for covalent grafting of organic moieties.[2] This peculiar chemical composition allows different functionalization methods of both surfaces that increase the HNTs application fields.[3]

In this context I report some recent progresses in my research group towards the development of functionalized-HNTs hybrids nanocomposites paying particular attention to the synthesis and characterization of the hybrids as well as their application in particular in drug carrier and delivery.[4]

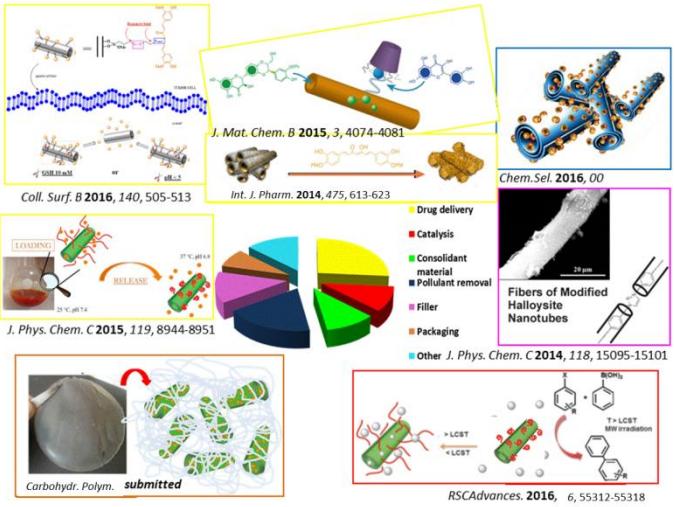

Figure 1: Some examples of HNT applications.

[1] (a)Lvov, Y.; Wang, W.; Zhang, L.; Fakhrullin, R., Halloysite *Adv. Mater.* **2016,** *28* (6), 1227-1250; (b) Bellani, L.; Giorgetti, L.; Riela, S.; Lazzara, G.; Scialabba, A.; Massaro, M., *Environ. Toxicol. Chem.* **2016**, *doi:10.1002/etc.3412*.

[2]Massaro, M.; Riela, S.; Cavallaro, G.; Gruttadauria, M.; Milioto, S.; Noto, R.; Lazzara, G. *J. Organomet. Chem.*, **2014**, *749*, 410-415.

[3](a)Pasbakhsh, P.; Churchman, G. J.; Keeling, J. L. *Appl. Clay Sci.*, **2013**, *74*, 47-57; (b) Arcudi, F.; Cavallaro, G.; Lazzara, G.; Massaro, M.; Milioto, S.; Noto R.; Riela, S. *J. Phys. Chem. C*, **2014**, *118*, 15095-15101.

[4](a) Massaro, M.; Riela, S.; Lo Meo, P.; Noto, R.; Cavallaro, G.; Milioto, S.; Lazzara, G. *J. Mater. Chem. B*, **2014**, *2*, 7732-7738; (b) Massaro, M.; Colletti, C. G.; Noto, R.; Riela, S.; Poma, P.; Guernelli, S.; Parisi, F.; Milioto, S.; Lazzara, G., *Int. J. Pharm.* **2015,** *478* (2), 476-485; (c) Massaro, M.; Riela, S.; Baiamonte, C.; Blanco, J. L. J.; Giordano, C.;. Lo Meo, P; Milioto, S.;. Noto, R; Parisi, F.; Pizzolanti, G.; Lazzara G. *RSC Adv.* ***submitted***.