Functionalization of titanate nanostructures for bioapplications

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Over the past decades, titania has been widely used in many applications namely implants, photocatalysis, drug delivery etc… It has actually demonstrated to be useful for bioapplications as titania is biocompatible and after surface modification, it can present specific bioactivity. However, until now, titania has mostly been used as nanoparticles whereas only little attention has been paid to other structures (i.e. nanowires, nanosheets…). More interestingly, in some cases, the use of titania nanosheets (TNS) instead of titania nanoparticles even led to an improvement of the materials properties[1]. For example, in drug delivery, the colloidal stability of the TNS is an important issue[2]. Indeed, the suspension must be stable (and the particles should not aggregate) in order to allow the TNS to act as nanocarriers.

Here we synthesized TNS (Figure 1) using a hydrothermal treatment. The chemical structure and properties of the synthesized TNS were characterized to ensure the formation of anatase. The adsorption of polyelectrolytes on the TNS (Figure 1) allowed to tune and tailor their properties (charge, mobility, aggregation rate…). Electrophoretic mobility and colloidal stability measurements were performed to determine the appropriate dose of polyelectrolytes needed to functionalize the TNS as well as the conditions under which the colloidal suspension is stable. Moreover, the polyelectrolyte coating led to a charge reversal of the nanosheets and to the enhancement of their stability. Therefore, polyelectrolyte functionalized TNS appear to be a method of choice to obtain stable TNS suspensions prior to their use as nanocarriers.

References

[1] Wang, Z.; Lv, K.; Wang, G.; Deng, K.; Tang, D. *Applied Catalysis B-Environmental* **2010**, *100*, 378.

[2] Pavlovic, M.; Adok-Sipiczki, M.; Horvath, E.; Szabo, T.; Forro, L.; Szilagyi, I. *Journal of Physical Chemistry C* **2015**, *119*, 24919.

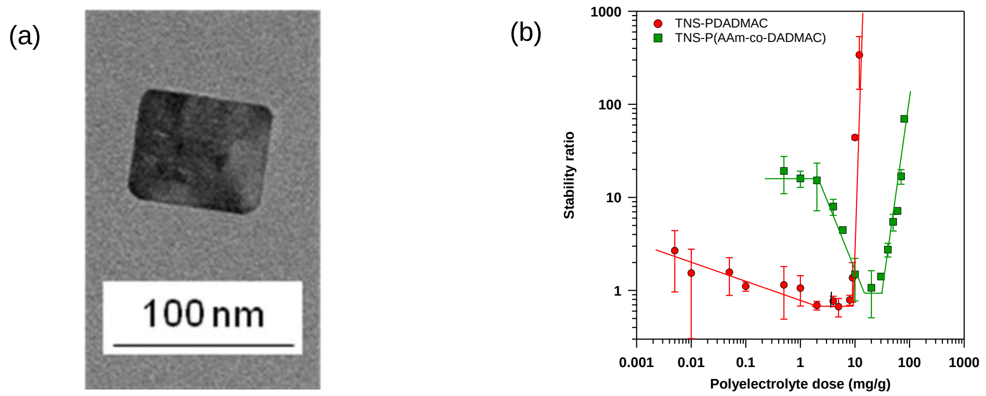

Figure 1. Transmission electron microscope image of a TNS (a) and stability ratio of PDADMAC and P(AAm-co-DADMAC) coated TNS (b). Please note that the values close to one correspond to fast aggregation of the particles while higher values indicate more stable systems.