

# Partial Zwitterionic Coating on MoS<sub>2</sub> Nanoplateforms for Non-Specific Cellular Uptake Regulation

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## Abstract

The application of 2D nanomaterials as diagnostic and therapeutic agents has attracted attention over the last decade. The success of such structures depends on whether we manage to engineer the 2D nanoplateforms in order to achieve desired specifications, to take control over specific and non-specific interactions with proteins, and to achieve high stability in physiological solution.

On one hand, the most commonly used strategy to enhance the biocompatibility of nanostructures and to prevent the undesirable adsorption of proteins onto the nanomaterial surface is to PEGylate them [1,2]. On the other hand, it was already demonstrated that unlike PEG which tends to agglomerate in saline media, zwitterionic coatings (for instance coatings from sulfobetaine derivatives) provide high stability over a wide range of pH [3]. Moreover, these coatings prevent non-specific protein adsorption onto the nanomaterial surface.

In this work we study the behavior of multi-component coatings on the

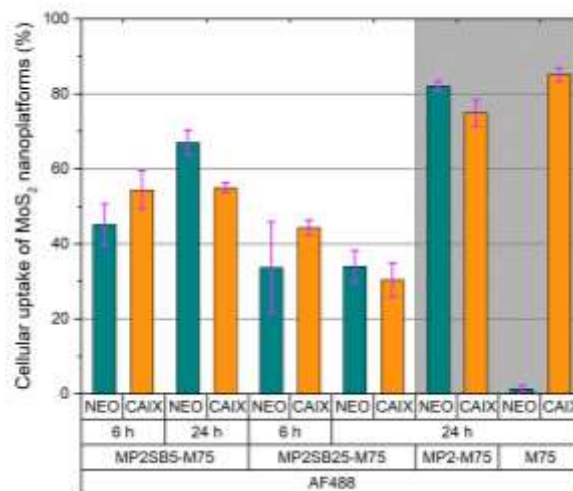
functionalization of MoS<sub>2</sub> nanosheets. By adjusting the proportion between the functionalizing agents, PEG and sulfobetaine, we control the specific and non-specific cellular uptake of the functionalized nanoplateforms.

The enclosed figure (Fig. 1) illustrates an increased cellular uptake of M75 bio-conjugated MoS<sub>2</sub> by CAIX expressing cells with shorter incubation times in the case of sulfobetaine-PEG mixed coating.

## References

- [1] Liu, T. et al., *Adv. Mater.* **26** (2014), 3433–3440.
- [2] Liu, T. et al., *Nanoscale* **6** (2014), 11219–11225.
- [3] García, K. P. et al., *Small* **10** (2014), 2516–2529.

## Figures



**Figure 1:** Cellular uptake estimation based on the flow cytometry measurements with Madin-Darby Canine Kidney (MDCK) mammalian cell line permanently transfected with full-length human carbonic anhydrase (CAIX), mock-transfected cells (neo) being used as control. The MoS<sub>2</sub> nanoplateforms with M75 antibody were labelled with fluorescent tag Alexa Fluor 488. The ratios of the functionalization agents sulfobetaine and PEG were 4:1 and 24:1 in the case of the samples MP2SB5 and MP2SB25, respectively. The sample MP2 was just PEGylated.