Understanding “in vivo” interfacial dynamics of therapeutic vectors through in situ ellipsometry.

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The last decade has seen the fast development of mesoporous silica nanoparticles as a biocompatible platform for drug delivery thanks to their tunable porosity, high loading capacity and the possibility to be functionalized with organic molecules to control cargo release and cell surface recognition.[1]
To design efficient nanocarriers and also to assess toxicity issues on human health, a good understanding of mesoporous silica particles biodegradability is mandatory.

However, the interfacial dynamics of these systems in real biological environments are still mostly unknown. In fact, if *in vitro* studies using simulated body fluids often give conflicting results, difficult to extrapolate towards a biological environment, *in vivo* tests are expensive and it's usually complicated to follow the dynamics taking place in this kind of experiments.
This research work wants to determine the dissolution rate of mesoporous silica under physiological conditions and identify some of the factors affecting silica behavior in biological media. The conducted study leads to interesting results which can be used to design *in vivo* tests.

We reproduce the structure and composition of mesoporous silica nanoparticles on 2D thin films and study them through *in situ* ellipsometric analysis in phosphate buffer, concentrated protein solution and in real biological media such as serum and blood.[2]
The ellipsometric analysis is fast and can be performed in liquid media. We can thus monitor protein adsorption/desorption kinetics and film hydrolytic intrinsic dissolution in the chosen fluid: this information is critical for drug delivery systems since dissolution defines the average residence time in the body and can drive drug release kinetics.
In particular, we wanted to explore the dynamic nature of bloodstream, which can affect the mechanisms of protein adsorption, particle dissolution and drug release. To do so, we developed a special ellipsometric setup which make us able to use opaque liquids (serum, blood) coupled with a microfluidic cell to control flow conditions (see Figure 1).
We monitored the influence of surface functionalization, pore size and geometry and medium flow on the interfacial behavior of mesoporous silica thin films.

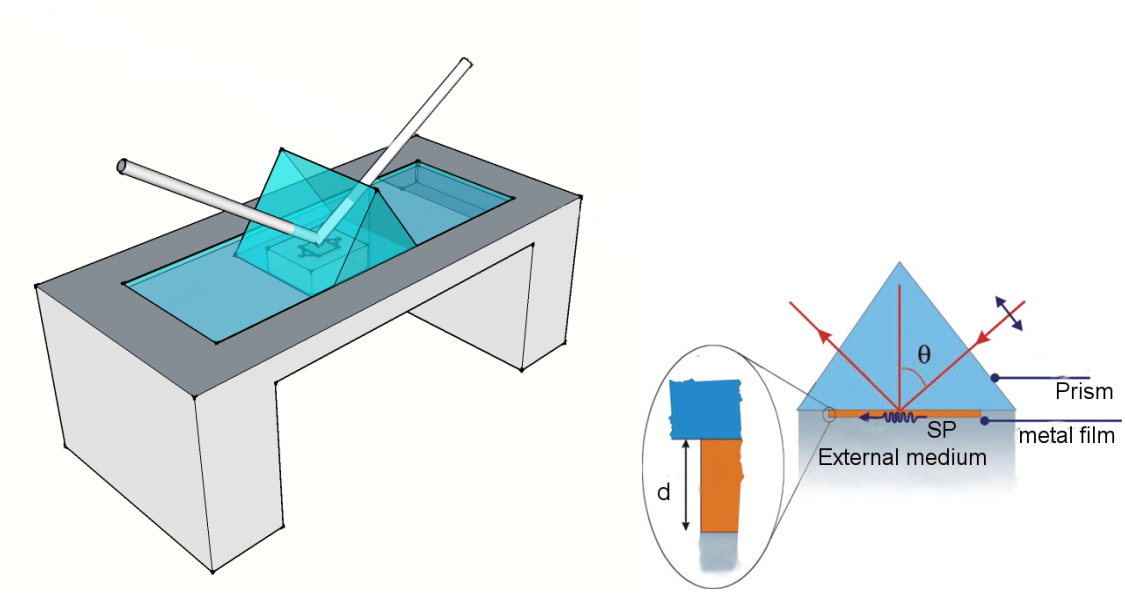

Figure 1 : Setup used for in situ ellipsometry in non-transparent media.

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