Experimental validation of a biosensing technique which monitors thermal changes at the interface

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A proof of principle of a biosensing technique is being presented which uses the Modified Transient Plane Source measurement technique to monitor thermal property changes at the surface of a biosensor. Characterisation measurements have been carried out whereby controlled changes at the interface of the sensor have been introduced. These experiments can be used as benchmark tests during the development and optimization of the biosensor.

Introduction

When performing measurements with functionalized biosensors, changes at the interface of the sensor occur. These changes can also lead to thermal property changes of the measured sample. Using a thermal based measurement technique, like the Transient Plane Source (TPS) method, these thermal changes can be measured over time. TPS is a measuring technique used to measure thermal properties of different bulk materials and is based on applying heat pulses to the sample [1, 2]. In this research, a proof of principle is presented which uses a modified version of the TPS technique, (MTPS), to monitor thermal property changes at the biosensor surface in real-time. This can be achieved by looking at the relative changes of the thermal characteristics of our sample at the interface of our sensor.

Results and Discussion

Measurements have been performed whereby controlled changes at the interface of the biosensor have been made. This included applying various thicknesses of polyimide tape to investigate the pulse penetration depth. Dissolving of thin films over time and monitoring the sedimentation of microparticles on the sensor. Hereby parameters such as the applied power, geometry of the sensor and penetration depth have been looked upon. Figure 1 shows a measurement where the sedimentation of microparticles was monitored. Between two Milli-Q steps microparticles where flushed onto the sensor. As these particles sediment, thermal property changes are detected on the sensor interface.

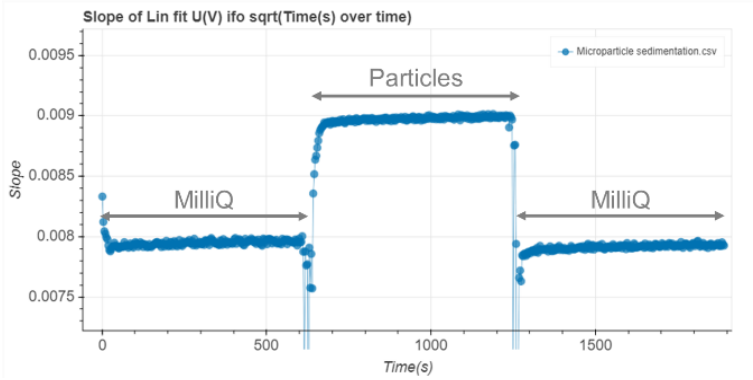

Figure 1: *Monitoring the sedimentation of microparticles on the sensor interface. Microparticles were flushed in between two Milli-Q steps. As sedimentation takes place, thermal property changes are detected.*

Conclusions

Using the Modified Transient Plane Source measurement technique in combination with biosensors, makes it possible to monitor relative thermal property changes at the sensor surface in real-time. Different parameters such as the applied power, sensor geometry and penetration depth can be monitored and taken into account during the development and improvement of the biosensor.

References

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