

Development of sample holders with thin SiN windows for PALS measurement of liquid samples

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At AIST we have used thin SiN windows to extract a slow positron beam from the vacuum chamber into atmosphere for in-situ positron annihilation lifetime spectroscopy (PALS) measurement of thin films as a function of humidity [1,2]. In principle this system can also be applied to the measurement of liquids by placing the liquid sample on the outside of the window. However, measurements with the focussed microbeam are time consuming and difficult to set-up. In addition, the window is fragile and a failure would lead to a catastrophic loss of vacuum integrity and possible damage to pumps etc.

In order to mitigate these disadvantages we have started to develop small liquid holders which can be placed into the vacuum chamber in a similar way to a typical sample. The liquid is placed in the centre of the holder and covered with a thin SiN window which is sealed with a rubber o-ring. As this system is designed to be used with an unfocussed positron beam, it is necessary to use somewhat thicker windows (~200 – 500 nm) as compared to those possible with the microbeam (~ 30 nm). The increased thickness requires a corresponding increase in beam energy in order to ensure most positrons annihilate in the sample rather than the window [3].

With this holder, we plan to perform PALS on a range of liquids. By varying the positron energy it is possible to vary the ratio of positrons which annihilate in the window compared to the liquid and hence observe any change in lifetime in the solid/liquid interface region compared to the bulk liquid. We will report preliminary measurements using these newly developed holders at the meeting.

[1] W. Zhou *et al.*, *Appl. Phys. Lett.* 101, 014102 (2012).

[2] W. Zhou *et al.*, *J. Phys. Conf. Ser.* 443 012090 (2013)

[3] B. E. O'Rourke *et al.*, *J. Phys. Conf. Ser.* 443 012069 (2013)