Wafer Device MPI

Issue/Version	Date	Author	Details
AAA	19/08/2011	R. Knowler	The Original
001	20/03/2012	G.Newell	Minor changes, issued into change control

1 Purpose

This document describes how to manufacture Wafer Devices for use with the Owlstone V-OVG.

2 Note on harmful substances

Using the method described below a wide range of Wafer Devices can be constructed.

Many of these could, if they burst, release toxic or harmful quantities of the material they contain. For this reason it is essential that the user conduct a **risk assessment** for the substances they intend to use and establish safety protocols that cope with the release of these materials both in normal operation, and in the case of a Wafer Device bursting and releasing its contents all at once.

These protocols must include suitable installation (e.g. in a fume cupboard, provision of extraction, etc.), a check of material compatibility, and operational procedures to protect the operator.

3 Equipment required

Diffusion tube parts

Diffusion tube body (stainless steel)

Lid (stainless steel)

PDMS membrane (polydimethylsiloxane)

Membrane holder (stainless steel)

Handle (stainless steel)

Cleaning materials:

Decon90

Acetone

Tools

Tweezers

Pipette

Oven

4 Wafer Device construction

1. The parts needed for construction of the Wafer Device are shown in Figure 1 below. A PDMS membrane is also required.

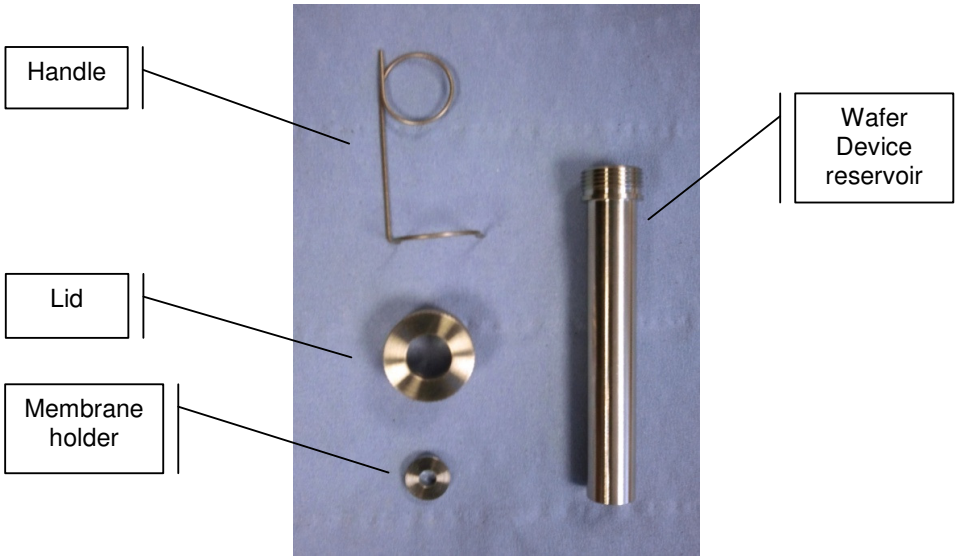

Figure 1 - Metal parts needed for Wafer Device construction

2. The metal parts should be cleaned before use with Decon90 and deionised water.
3. Rinse with acetone and bake out overnight in an oven. The PDMS membranes should be baked out in an oven at 200 ℃ before use.
4. The Wafer Device reservoir has a total volume of 5 ml, carefully add 2.5 ml of the chemical required to the reservoir using a pipette.

Figure 2 - Adding the chemical to the Wafer Device reservoir

5. Using clean tweezers, insert the PDMS membrane into the top of the reservoir and ensure that it is evenly pushed down. **** Be very careful not to damage the membrane ****

Figure 3 - Inserting the PDMS membrane

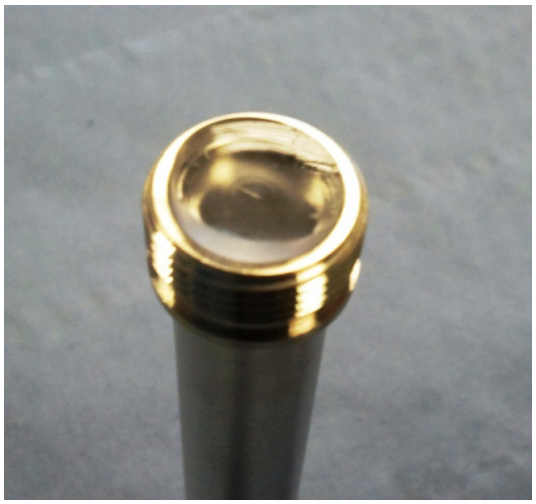

Figure 4 - PDMS membrane pushed evenly into the reservoir

6. Place the membrane holder on top of the PDMS membrane, with the smaller face uppermost and making sure it is centred.

Figure 5 - The membrane holder is positioned

7. Carefully screw the lid onto the reservoir of the Wafer Device.

Figure 6 - The lid is screwed on

8. Finally the handle can be pushed onto the lid. Make sure the wire of the handle sits well in the groove around the lid.

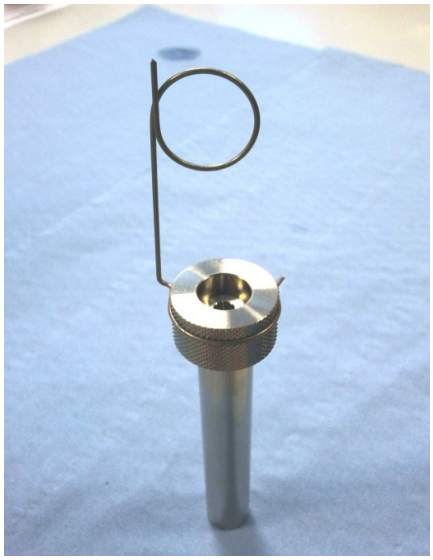

Figure 7 - The handle is attached

9. The diffusion tube can now be put into a V-OVG and taken out again by using the handle.

5 Wafer Device Calibration

Wafer devices are typically calibrated gravimetrically.

An alternative method uses gas chromatograph - mass spectrometer (GC-MS). Whilst GC-MS often offers a quicker route to calibration the method is not always suitable nor the equipment / expertise available.

Gravimetric calibration

After construction weigh the Wafer Device using an analytical 4 point balance (n=3).

The wafer device should then be incubated in an **Owlstone V-OVG.** After an initial three day stabilisation period (this may be shortened if the analyte has a low boiling point) the wafer device should be periodically weighed.

This process is repeated until enough data points are acquired to provide a good calibration. Depending on the permeation rate this process may take between two weeks and six months.

An example of a Toluene diffusion tube calibration is shown in Figure 12, this plots *cumulative mass loss* in ng vs. *time* in minutes. The slope of the fitted line is equal to the diffusion rate in ng min^{-1}.

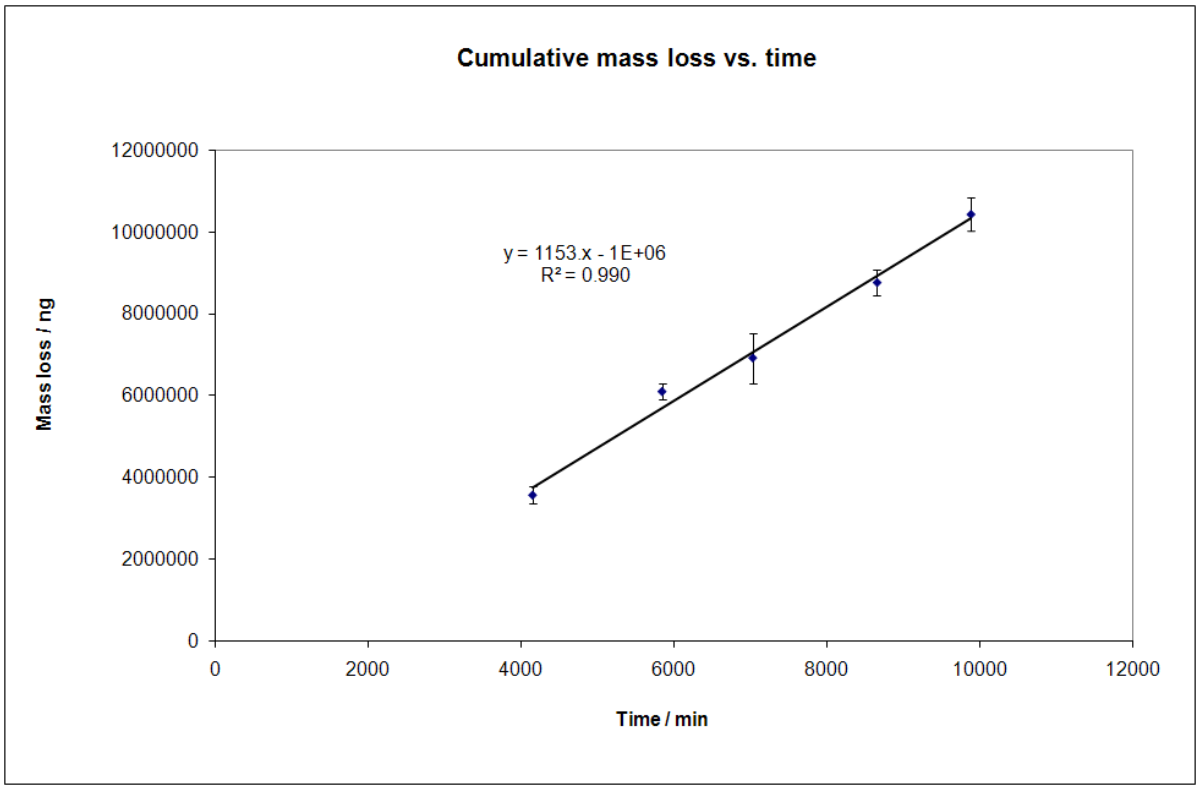

Figure 10: An example of a toluene calibration, the slope is equal to the diffusion rate in ng min^{-1}