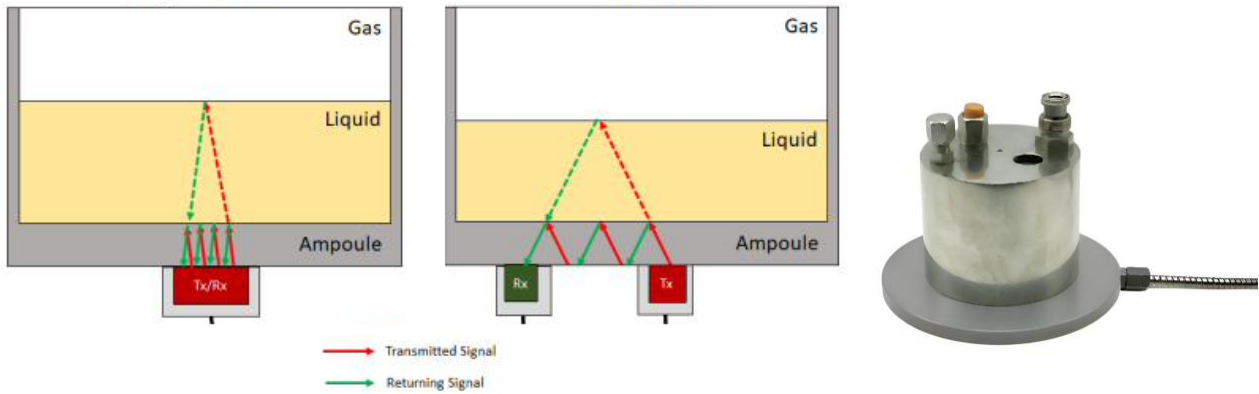


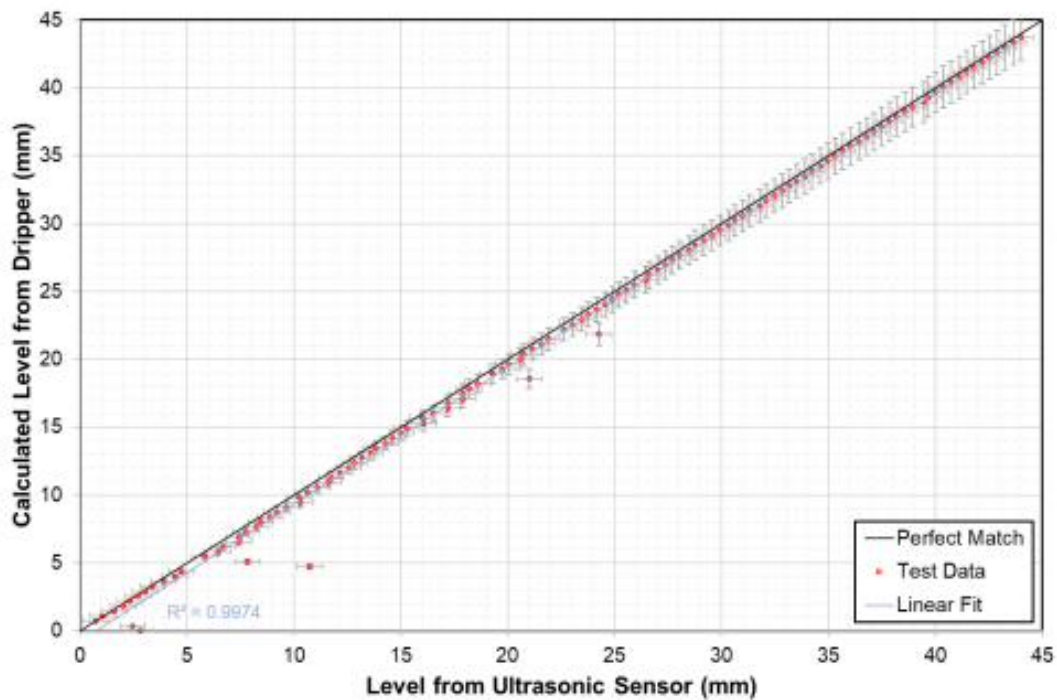
Ultrasonic Level Sensing for ALD Precursors Through the Ampoule Wall

Figure 1 Acoustic path and coupling arrangement



Left: pulse echo geometry. A longitudinal pulse launched at the outer face of the ampoule base propagates through the vessel wall and the liquid column and reflects at the liquid vapor interface. The echo delay gives the product of propagation velocity and path length. Single element and pitch catch geometries were both evaluated. Right: assembly coupled to the base of a test ampoule; the complete measurement chain sits outside the process boundary.

Figure 2 Recovered height against independent reference



Recovered height against a calibrated dripper reference in silicone oil, a strongly attenuating fluid chosen as a worst case for signal propagation. Agreement is approximately 1 mm with $R^2 = 0.997$, continuously over the full range rather than at a set of fixed detection heights. Equivalent performance is retained from room temperature to 150 C and through repeated heating and cooling cycles.