

High accuracy calibration of a dynamic vapor sorption instrument and determination of the equilibrium humidities using single salts - DTU Orbit (09/11/2017)

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We present a procedure for accurately calibrating a dynamic vapor sorption (DVS) instrument using single salts. The procedure accounts for and tailors distinct calibration tests according to the fundamental properties of each salt. Especially relevant properties influencing the calibration are the heat of solution, heat of condensation, and the kinetics connected to the salt phase transition, as these influence the microclimate surrounding the salts during calibration. All these issues were dealt with to obtain precise calibration results. The DVS instrument comprises two control modes to generate and measure the relative humidity (RH). Both control modes were separately examined and combined to overcome the shortcomings of each of the two control modes and thereby obtain the most accurate results. Repeated calibration testing with the single salts (LiCl, MgCl₂, Mg(NO₃)₂, NaCl, and KNO₃) enables five discrete sorption isotherm measurements within the range of 11%–93%RH. The equilibrium RH of the solution for LiCl, MgCl₂, Mg(NO₃)₂, NaCl, and KNO₃ was determined with a standard deviation of 0.06%–0.15% (0.45% for KNO₃) RH. By comparing the measured calibration values with the well-known equilibrium RH of each salt solution, the presented method's results are both accurate with significant agreement and precise with small variation.

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