Humidity Fixed Points

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Occasionally, one wishes to perform a thermal analysis experiment in which the purge gas over the test specimen has a specific humidity. Bubbling the purge gas through a series of saturated salt solutions is one way to achieve the desired humidity results. The appended table provides humidity fixed points ranging from 10 to 90 % relative humidity for the indicated saturated salt solutions. Generally speaking, humidity greater than 90 % is not used in thermal analysis experiments due to the risk of condensation.

Passing the purge gas through a series of at least three fine-frit bubblers or "spargers" is sufficient to achieve the desired humidity. The first bubbler in the series chain is selected to obtain a relative humidity much higher that the desired value (such as with pure water), while the second and third bubblers are set for the humidity of interest.

To prepare a saturate salt solution, the indicated salt is added to warm (about 40 °C) distilled water with stirring until no more salt dissolves. Additional salt is added to ensure an excess of the saturating salt. Table 2 provides approximate compostions for saturated solutions. The saturated solution is then cooled to ambient temperature and allowed to set for at least 24 hours before use. All salt crystals should be covered by the solution.

The series of spargers is best placed in the purge gas stream immediately before it enters the furnace. This is convenient on the TGA but is difficult on other modules. In these other cases, the series of spargers may be placed in the purge gas stream before it enters the purge gas port on the back of the instrument.

Table 1
HUMIDITY FIXED POINTS

L. Greenspan, "Humidity Fixed Points of Binary Saturated Aqueous Solutions", *Journal of Research of the National Bureau of Standards - A. Physics and Chemistry*, **1977**, 81A (1) pp. 89-96

Temperature (°C)	Lithium Chloride	Potassium Acetate	Magnesium Chloride	Potassium Carbonate	Magnesium Nitrate	Sodium Bromide	Strontium Chloride	Sodium Chloride	Potassium Chloride
10	11.3	23.7	33.5	43.1	57.4	62.2	75.66	75.7	86.8
15	11.3	23.4	33.3	43.2	55.9	60.7	74.13	75.6	85.9
20	11.3	23.1	33.1	43.2	54.4	59.1	72.52	75.5	85.1
25	11.3	22.5	32.8	43.2	52.9	57.6	70.85	75.3	84.3
30	11.3	21.6	32.4	43.2	51.4	56.0	69.12	75.1	83.6
35	11.3	---	32.1	---	49.9	54.6	---	74.9	83.0
40	11.2	---	31.6	---	48.4	53.2	---	74.7	82.3
45	11.2	---	31.1	---	46.9	52.0	---	74.5	81.7
50	11.1	---	30.5	---	45.4	50.9	---	74.4	81.2
55	11.0	---	29.9	---	---	50.2	---	74.4	80.7
60	11.0	---	29.3	---	---	49.7	---	74.5	80.3
65	10.9	---	28.5	---	---	49.5	---	74.7	79.9
70	10.8	---	27.8	---	---	49.7	---	75.1	79.5
75	10.6	---	26.9	---	---	50.3	---	75.6	79.2
80	10.5	---	26.1	---	---	51.4	---	76.3	78.9

Table 2
APPROXIMATE COMPOSITION OF SATURATE SALT SOLUTIONS

R. Jowitt and P.J. Wagstaffe, "The Certification of the Water Content of Microcrystalline Cellulose at 10 Water Activities", Commission of the European Communities, EUR 12429, Luxembourg, 1989

Salt	Humidity at 25 °C (%)	Salt (g)	Water (mL)
Lithium Chloride	11.3	150	85
Potassium Acetate	22.5	200	65
Magnesium Chloride	32.8	200	25
Potassium Carbonate	43.2	200	90
Magnesium Nitrate	52.9	200	30
Sodium Bromide	57.6	200	80
Strontium Chloride	70.85	200	60
Sodium Chloride	75.3	200	60
Potassium Chloride	84.3	200	80

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