Supplementary Information for

Crystal form selectivity by humidity control: the case of the ionic cocrystals of nicotinamide and CaCl₂

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TGA measurements.

Despite all attempts to obtain pure compounds, the TGA curves suggests the presences of a small amount of $CaCl_2 XH_2O$. It is known that the dehydration process of $CaCl_2 XH_2O$ strongly depends on the heating rate and a recent study shows that at ~142°C there is a complete conversion of $CaCl_2 6H_2O$ to the anhydrous form.¹

In figure S.I. 1 the small step between 90-130°C could be ascribed to the release of water due to the presence of small percentage of $CaCl_2 XH_2O$ not detectable by X-ray diffraction, while step between 130°C to 200°C the release of the crystallization water molecule of Nic·CaCl₂·H₂O (calc 7.16% obs. 6.59%) and the formation of the anhydrous form. At 250°C the decomposition occurred.

The variable temperature XRD shows no changes in the pattern between 90°C-130°C also after the sample was kept at 100°C for 1 hour (see figure S.I. 2)



Figure SI 1. TGA curves of Nic·CaCl₂·H₂O. Sample obtained by kneading CaCl₂ anhydrous and Nicotinamide with 1 drop of ethanol. The sample was kept at 75°C for at least 1 hour to remove adsorbed water. The first step between 90°C-140°C is ascribable to the release of water due to the presence of $CaCl_2 \cdot xH_2O$.



Figura SI 2. Variable temperature XRD patterns of Nic·CaCl₂·H₂O powder. No ICC phase transition is detected in the range 90-130C

Nic·CaCl₂·4H₂O loses three water molecules before 90°C. After this temperature the thermogram is comparable to that one observed for Nic·CaCl₂·H₂O; also in this case there is a step between 90°-130°C is due to the presence of a small percentage of CaCl₂ XH₂O (Figure S.I. 3)



Figure SI 3. TGA curves of Nic·CaCl₂·4H₂O. Sample obtained exposing Nic·CaCl₂·H₂O to HR 75%.

Rietveld refinements of patterns collected on powders exposed to different RH

Rietveld refinement of the diffractogram collected on the sample of Nic·CaCl₂ after been exposed to HR 12% for two weeks (2θ range 5-40°, step size 0.02°, time/step 20 s, 0.04 rad soller, kVxmA 40x40). The pattern has been described by two crystalline phases: Nic·CaCl₂ and Nic·CaCl₂·H₂O. The refinement converged to $R_{wp} = 8.635\%$ and $\chi^2 = 1.734$ values



Figure S.I. 4 Experimental (black dots), calculated (red line) and difference (grey line) patterns for Nic·CaCl₂·H₂O (black line) after two weeks at 12% RH. Peak positions are marked in red and green for Nic·CaCl₂ and Nic·CaCl₂·H₂O respectively

Rietveld refinement of the diffractogram collected on the sample of Nic·CaCl₂ after been exposed to HR 53% for two weeks (2θ range 5-40°, step size 0.02°, time/step 20 s, 0.04 rad soller, kVxmA 40x40). The pattern has been modelled using three phases: Nic·CaCl₂·H₂O, triclinic CaCl₂·4H₂O and trigonal CaCl₂·2H₂O. The refinement converged to $R_{wp} = 8.777\%$ and $\chi^2 = 1.426$ values.



Figure S.I. 5 Experimental (black dots), calculated (red line) and difference (grey line) patterns for Nic·CaCl₂·H₂O (black line) after two weeks at 54% RH. Peak positions are marked in red, green and blue for Nic₂·CaCl₂·2H₂O, CaCl₂·4H₂O and CaCl₂·2H₂O respectively.