JOURNAL OF APPLIED CRYSTALLOGRAPHY

Volume 54 (2021)

Supporting information for article:

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Supporting Information

Morphology Control of Laser Induced Dandelion-like Crystals of Sodium Acetate through the Addition of Acidic Polymers

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1. **The Explanation of Abbreviations of PM-n and PA-n:** In the research, each sample was individually added by one type of additives. In Table 1, PM/PA−0 is the samples without additives, which means that the samples were original solutions. Using "PM/PA−0" is to simplify the description when original solutions and samples with different mass fractions of PM or PA could cause one type of results or phenomenon, for example, PM 0−1/PA 0−2 means that samples contain either 0−0.088 wt% PM or 0−0.264 wt% PA that can lead to the same result or condition; PM 3–4 means that samples contain 0.397 wt%−3 wt% PM, and different abbreviations applied in experiments are summarized in Table S1.

Table S1. The range of mass fractions of additives for abbreviations

Abbreviation	Range of Mass Fractions of Additives in Samples
PM 0−1	Samples contain 0−0.088 wt% PM.
PA 0−2	Samples contain 0−0.264 wt% PA.
PM 3–4	Samples contain 0.397 wt%−3 wt% PM.
PA 2-4	Samples contain 0.238 wt%−3 wt% PM.
PM/PA-0	No additives in samples (original solution).
PM/PA-1	= PM-1/PA-1; Samples contain 0.079 wt%−0.088 wt% PM or PA.
PM/PA 2-4	= PM 2-4/PA 2-4; Samples contain 0.238 wt%−3 wt% PM or PA.
PM 0−1/PA 0−2	Samples contain either 0−0.088 wt% PM or 0−0.264 wt% PA.
PM 0–2/PA 0–3	Samples contain either 0−0.264 wt% PM or 0−0.441 wt% PA.

2. **Control Experiments:** the solubility of CH_3COONa solutions at 20 °C is 1.23 g g^{-1}; with the effects of PM/PA, the solubility will be slightly increase, this would influence supersaturation. In the control experiments, saturated CH_3COONa solutions at 20 °C were made, the powder of CH_3COONa anhydrous would be added to measure the new solubility when PM/PA-3 was added. As the value of PM/PA-3 in solution is only around 0.441 wt%, the new solubility nearly remains unchanged, so the effect of PM/PA1-3 on solubility is almost negligible.

3. Optical Setup for NPLIN:

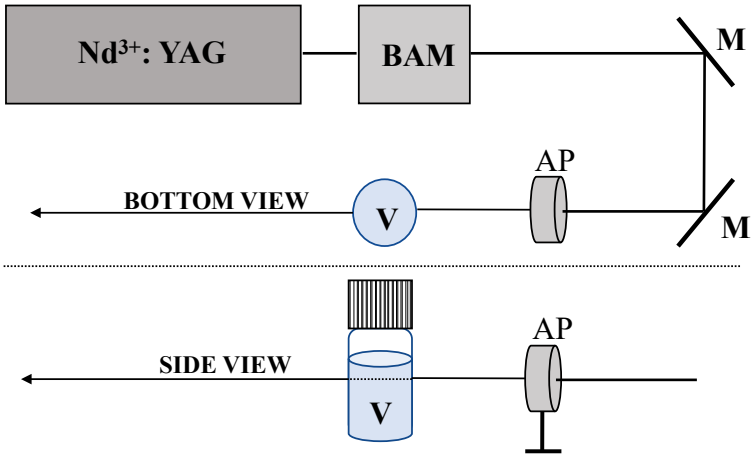

Figure S1. Schematic layout of optical setup for NPLIN on supersaturated CH_3COONa sample. The output wavelength of Nd^{3+}: YAG laser is 1064 nm; laser power is controlled by a beam attenuator module (BAM). Coated laser mirror (M) is used to adjust beam pathway. The diameter of the input beam is reduced to 2.5 mm using a circular aperture (AP) from an original diameter of 6.5 mm, and the center of sample vial (V) is placed in the laser pathway, as illustrated.

4. Electronic Supporting Information Video

Crystals of CH_3COONa occur immediately after laser pulse, and the video S1-2 is speeded up in order to decreasing the size of video to upload in the system.

Video S1. Example video showing a single laser pulse irradiated onto a vial containing the supersaturated CH_3COONa solution **with PA-2**.

Video S2. Example video showing a single laser pulse irradiated onto a vial containing the supersaturated CH_3COONa solution **with PA-3**.

5. Characterization Supplementary

The crystal powder (0.01-0.05 g) was dissolving with hydrochloric acid (Analytical reagent 35 %) with 5 mL, and then solution was diluted into 250 mL constant volume. The proportion of sodium element was determined by Atomic Absorption Spectrometry (AAS, GGX-600) with detection wavelength of 589.1 nm. The sodium element in crystal powder is 26.21wt%, and the purity of sodium acetate anhydrous was 93.47 wt% in the crystal powder. The crystal powder obtained by laser in solution with PM 2 was also analyzed by SEM, Figure S2 revealed that the polymer is unlikely to entrain into crystals. Figure S3-S4 shows the XRD patterns for anhydrous and trihydrate forms, respectively.

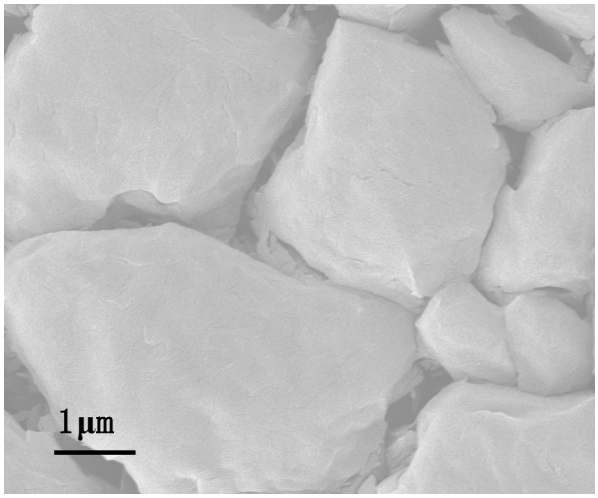

Figure S2. SEM images of anhydrous CH3COONa crystals obtained in the presence of 0.238 wt%~0.264 wt% polymer acids due to NPLIN.

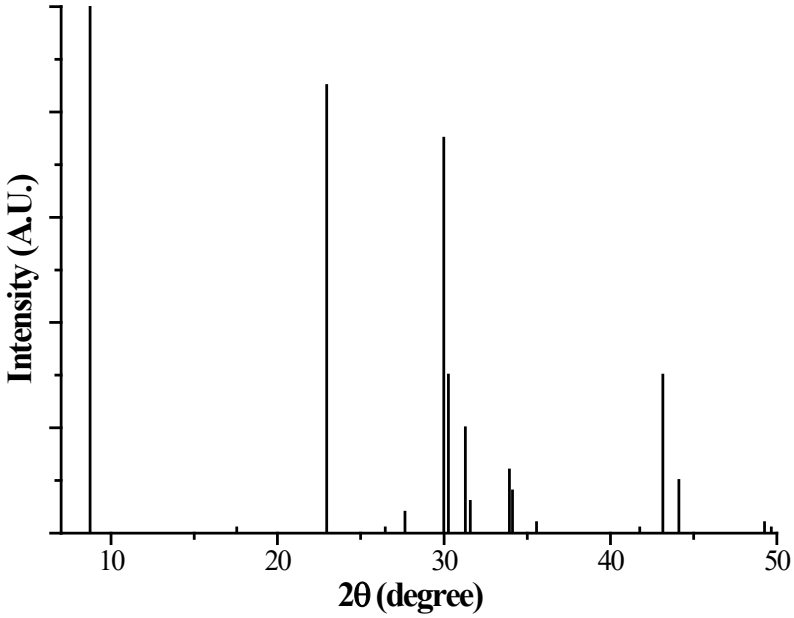

Figure S3. XRD patterns of sodium acetate anhydrous from PDF card 28-1029.

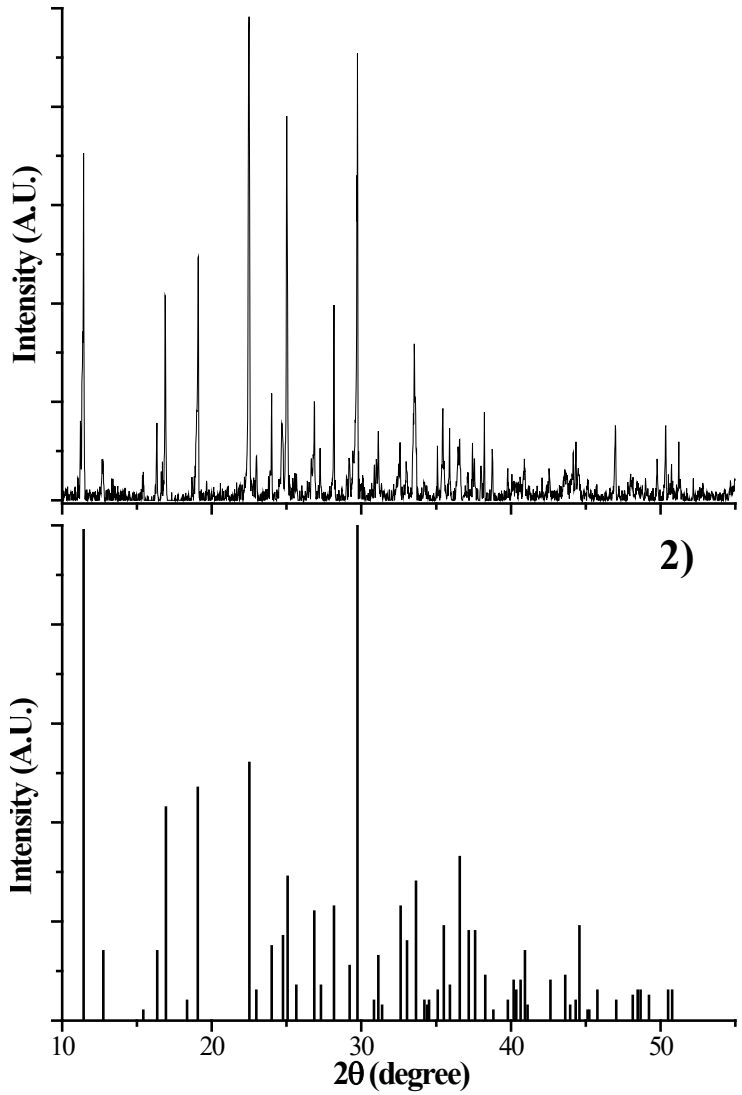

Figure S4. XRD patterns of trihydrate sodium acetate. (1) XRD patterns of experimental trihydrate forms; (2) XRD patterns obtained from PDF card 29-1160.

6. The Results of Bulk Solid Thickness versus Time in the Presence of PM

In section 3.2, it revealed that the inhibition of crystal growth with PM is stronger than that with PA. Specifically, PM-1 takes 25 mins for all whole solution to complete crystallization; PM-2 experiences 3-4 hours to complete crystal growth; no crystals occur after NPLIN in solution with PM-3 whilst solutions with PA-3 are able to produce crystals after one single pulse. The results of crystal thickness versus time in the presence of PM is summarized in Figure S5.

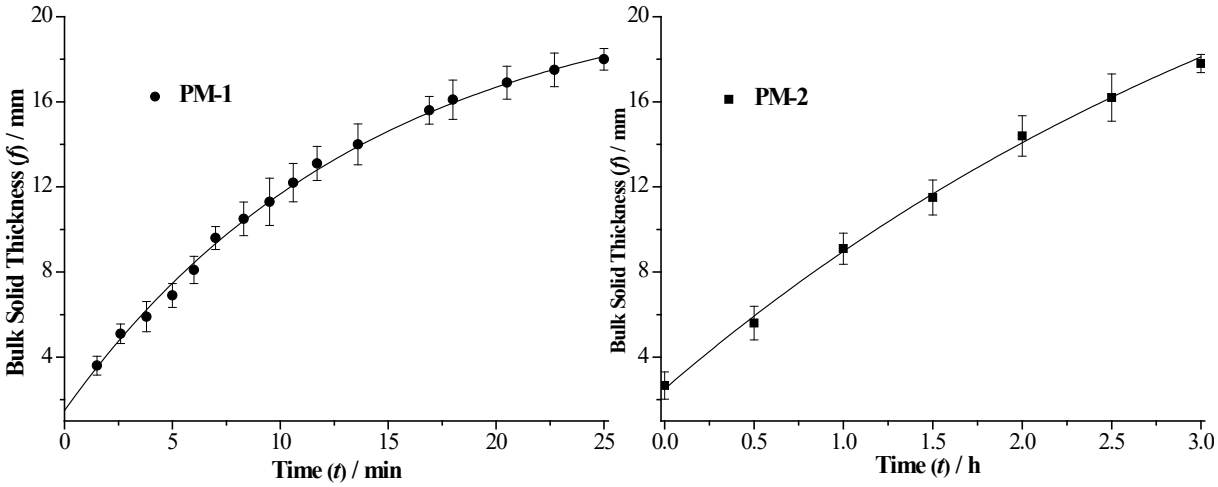

Figure S5. Plots of bulk solid thickness of anhydrous CH_3COONa crystal growth against time after a single laser pulse for equivalent supersaturation (1.15) with the presence of PM 1-2. Circles and squares represent data for PA-1(1) and PM-2 (2), respectively. Polynomial function fits to the data are shown as solid lines.

7. The Viscosity of the Solution with the Presence of PM

The viscosity of solutions was measured by an automatic Ubbelohde viscometer (WM6500), the temperature was set at 20 °C. Utmost care was also taken during the measurement of viscosity as supersaturated solution was metastable and easily spontaneous nucleated to block off the viscometer. The value of viscosity from 0.5 wt% to 3 wt% PM is listed in Table S2. As can be seen in Table S2, the viscosity in 0.5-3 wt% PM is higher than the value without additives, the value of viscosity increases with increase of mass fraction of PM in solution. Thus, the addition of PM could increase the viscosity of a solution.

Table S2. the value of viscosity from 0.5 wt% to 3 wt% PM

Mass fraction of PM / wt%	viscosity (η) / mPa.s in water	viscosity (η) / mPa.s in solution
0	1.01	38.33
0.5	1.64	39.01
1	1.74	40.16
2	2.97	42.21
3	4.12	44.45