Supporting Information

The Effect of Acidic Polymers on Morphology of Laser-Induced Nucleation of Cesium Chloride

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Supporting Information

1. Preparation of supersaturated CsCl solutions with different mass fraction of PESA

A stock supersaturated CsCl solution was prepared at 20 °C with supersaturation of 1.15. As samples were made with different mass fraction of PESA, the addition of PESA aqueous solution (40 wt%), CsCl powder, and ultrapure water should be initially calculated as the mass of water in PESA solution could highly influence supersaturation. The supersaturation of all samples was identical (1.15) at fixed temperature of 20 °C, the concentration of supersaturated CsCl solution was 2.15 g g⁻¹ [CRC Handbook of Chemistry and Physics, 97 st (Internet Version 2016-2017); W. M. Haynes, Ed.; CRC Press: Boca Raton, FL, 2016.], which was calculated from Figure S1. If the addition of ultrapure water was fixed at 20 g, the grams of added PESA aqueous solution and CsCl powder could be obtained for samples with different mass fractions of PESA, which was shown in Figure S2 and Table S1.

![CsCl Solubility](image)

**Figure S1.** The solubility of CsCl at different temperature.
Figure S2. Added CsCl powder (a) and PESA aqueous solution (b) versus mass fraction of PESA in solution. Supersaturation of 1.15 at 20°C and 20 g added ultrapure water is fixed.

Table S1. Mass of components in each of solutions (1.15 supersaturation) with 20 g ultrapure water corresponding to mass fraction of PESA.

| Mass Fraction of PESA in Solution (wt%) | Mass of Components |
|----------------------------------------|--------------------|
|                                        | CsCl Powder (g)    |
|                                        | PESA aqueous solution (g) |
| 0.12                                   | 43.26              |
| 0.2                                    | 43.42              |
| 0.3                                    | 43.63              |
| 0.5                                    | 44.06              |
| 0.8                                    | 44.71              |
| 1.0                                    | 45.17              |

2. Electronic supporting information video

Video S1. Example video showing a single laser pulse irradiated onto a vial containing the supersaturated CsCl solution without additives. Crystals of cesium chloride occur immediately after laser pulse; the sizes and shapes of crystals are heterogeneous.

Video S2. Example video showing a single laser pulse irradiated onto a vial containing the supersaturated CsCl solution with 0.2 wt% PESA. The sizes and quantity of crystals of cesium chloride are much smaller and fewer than that in sample without PESA; the sizes and shapes of crystals are nearly identical.

3. Associated content of Figure 6.

The exponential function fitting to the data in Fig. 6 of main text is \( f(n) = 0.0858 + 0.88428 e^{-7.6387n} \), where \( n \) is mass fraction of PESA, \( f(n) \) is mean particle size; the standard deviation and Particle sizes from 0 – 0.3 wt% PESA / PASA are given in Table S2; the particle sizes from 0.5 wt% - 5wt% PESA and 1wt% - 5wt% PASA are nearly the same as their mean size (0.11mm ~0.06 mm), and their standard deviation can be negligible as the values are fairly small compared to their mean sizes. For the condition of no additives added, the crystal growth rates
are fast and crystal sizes highly increase. Meanwhile, the size for each crystal seems different, and the number of crystals induced by laser is fairly large (>50), measuring size for each crystal is hardly practical as some crystals could block off the vision of crystals behind them, so only 36 crystal sizes are measured for solution without additives in Table S2; For the condition of 0.2–0.3 wt% PESA/PASA, crystal number and size are largely decreased especially for 0.3 wt% PESA/PASA. Specifically, the number of crystals is around 45 at 0.2 wt% whilst the number of crystals is decreased to around 10 at 0.3 wt%.

Table S2. Mean particle size, particle size of single crystal, and standard deviation for 0–0.3 wt% PESA / PASA.

| No. | Additives | 0.2 wt% PESA | 0.3 wt% PESA | 0.2 wt% PASA | 0.3 wt% PASA |
|-----|-----------|--------------|--------------|--------------|--------------|
| Mean Size / mm | 0.97 | 0.28 | 0.17 | 0.68 | 0.38 |
| Standard Deviation | 0.247 | 0.057 | 0.013 | 0.229 | 0.087 |

| NO. | Particle Size/ mm |
|-----|-------------------|
| 1 | 1.01 | 0.29 | 0.19 | 0.63 | 0.47 |
| 2 | 0.87 | 0.27 | 0.19 | 0.34 | 0.58 |
| 3 | 1.26 | 0.4 | 0.17 | 0.28 | 0.33 |
| 4 | 1.11 | 0.28 | 0.19 | 0.63 | 0.25 |
| 5 | 0.79 | 0.29 | 0.17 | 0.49 | 0.36 |
| 6 | 1.47 | 0.29 | 0.17 | 0.49 | 0.35 |
| 7 | 0.55 | 0.31 | 0.16 | 0.68 | 0.42 |
| 8 | 0.52 | 0.27 | 0.15 | 0.46 | 0.37 |
| 9 | 0.64 | 0.26 | 0.16 | 1.07 | 0.37 |
| 10 | 0.94 | 0.23 | 0.17 | 0.6 | 0.31 |
| 11 | 1.35 | 0.26 | 0.43 | 0.61 | 0.52 |
| 12 | 0.91 | 0.36 | 0.58 | 0.38 | 0.37 |
| 13 | 0.62 | 0.31 | 0.56 | 0.6 | 0.74 |
| 14 | 1.25 | 0.22 | 0.61 | 0.59 | 0.55 |
| 15 | 0.86 | 0.24 | 0.71 | 0.77 | 0.9 |
| 16 | 0.82 | 0.28 | 0.52 | 0.62 | 0.62 |
| 17 | 0.85 | 0.22 | 0.77 | 0.95 | 1.03 |
| 18 | 1.23 | 0.25 | 0.81 | 0.81 | 0.69 |
| 19 | 1.18 | 0.24 | 0.55 | 0.33 | 0.52 |
4. Measurements of dielectric constant and viscosity

The dielectric constants of solutions were measured by a dielectric constant tester (ITACA, DKV1) with 1-mL pyrex holder, the frequency of the measurements was 2.45 GHz. Samples was introduced in standard 1 mL vial, and the system was calibrated with an empty vial. After that, the Dielectric Kit provided the material dielectric properties without any additional calibration, the accuracy of dielectric constant was 1-2 % in real part range. The value of dielectric constants of solution with 8 wt% PESA was measured at 1.695.

The viscosity of solutions was measured by an automatic Ubbelohde viscometer (WM6500), the temperature was set at 20 °C. The value of viscosity from 1 wt% to 8 wt% PESA is listed in Table S3. As can be seen in Table S3, the viscosity in 1-8 wt% PESA is higher than the value without additives (1.504 mPa.s), and the value increases with the increase of mass fraction of PESA. Thus, the addition of PESA could increases the viscosity of a solution.

Table S3. the value of viscosity from 1 wt% to 8 wt% PESA

| Mass fraction of PESA / wt% | viscosity (η_L) / mPa.s |
|----------------------------|------------------------|
| 1%                         | 5.727                  |
| 3%                         | 7.245                  |
| 5%                         | 8.176                  |
| 8%                         | 10.334                 |