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# Ice nucleation activity of silicates and aluminosilicates in pure water and aqueous solutions – Part 1: The K-feldspar microcline

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**S1 DSC Thermograms of immersion freezing with emulsions of freshly prepared microcline suspensions in water or aqueous solutions**

We show one set of DSC thermograms (1 K $min^{-1}$ cooling cycle) for each solute concentration for the freshly prepared and tested emulsions.

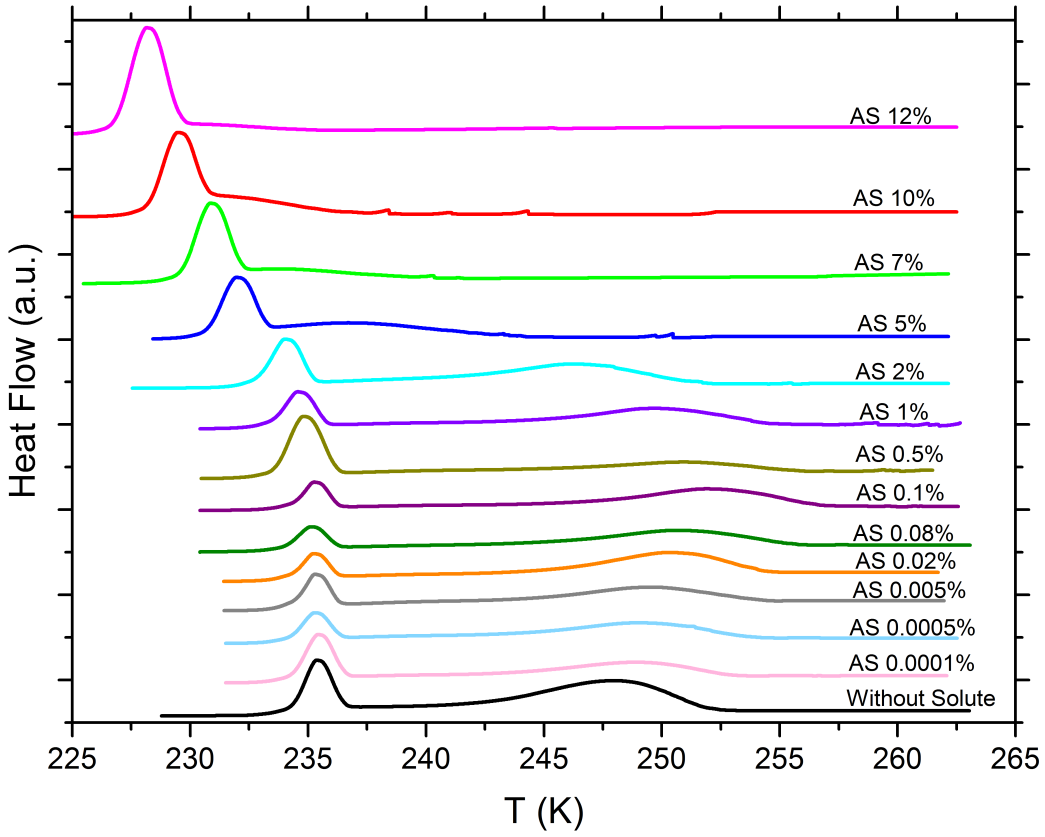


**Figure S1.** DSC thermograms of 2 wt% of microcline particles suspended in ammonium sulfate (AS) solution droplets of varying concentration. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value. Numbers next to each curve: Solute Concentration (in wt%) AS: Ammonium Sulfate

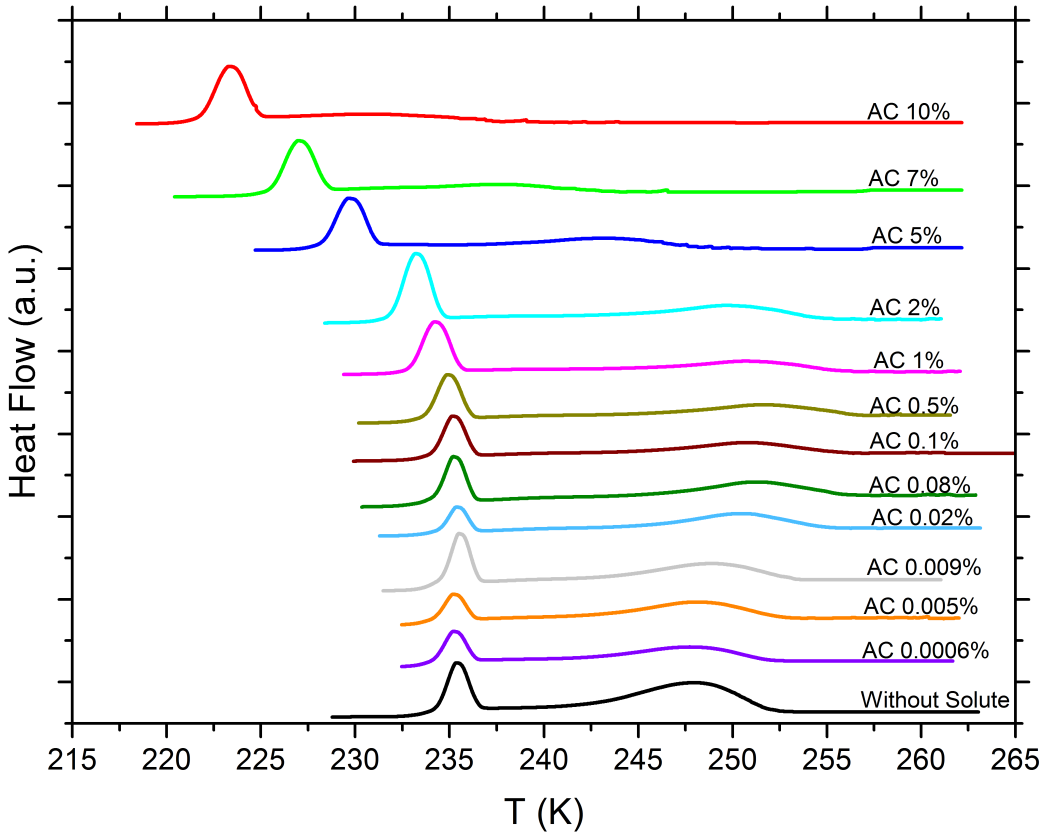


**Figure S2.** DSC thermograms of 2 wt% of microcline particles suspended in ammonium chloride (AC) solution droplets of varying concentration. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value. Numbers next to each curve: Solute Concentration (in wt%) AC: Ammonium Chloride

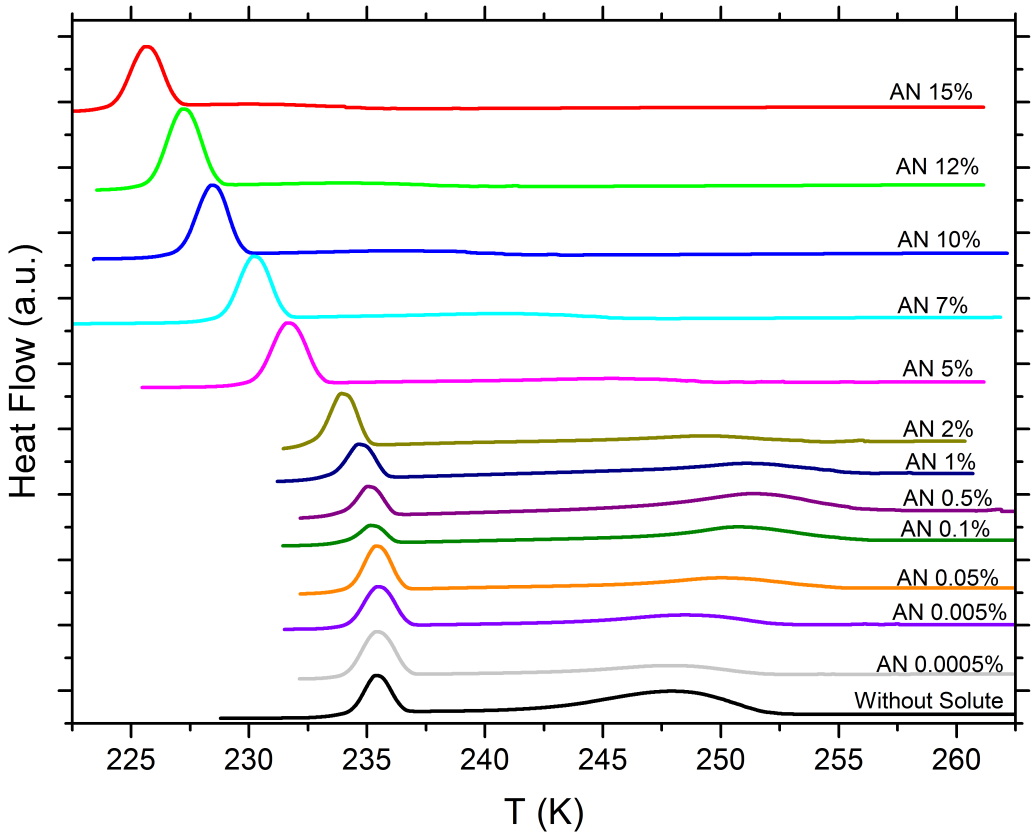


**Figure S3.** DSC thermograms of 2 wt% of microcline particles suspended in ammonium nitrate (AN) solution droplets of varying concentration. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value. Numbers next to each curve: Solute Concentration (in wt%) AN: Ammonium Nitrate

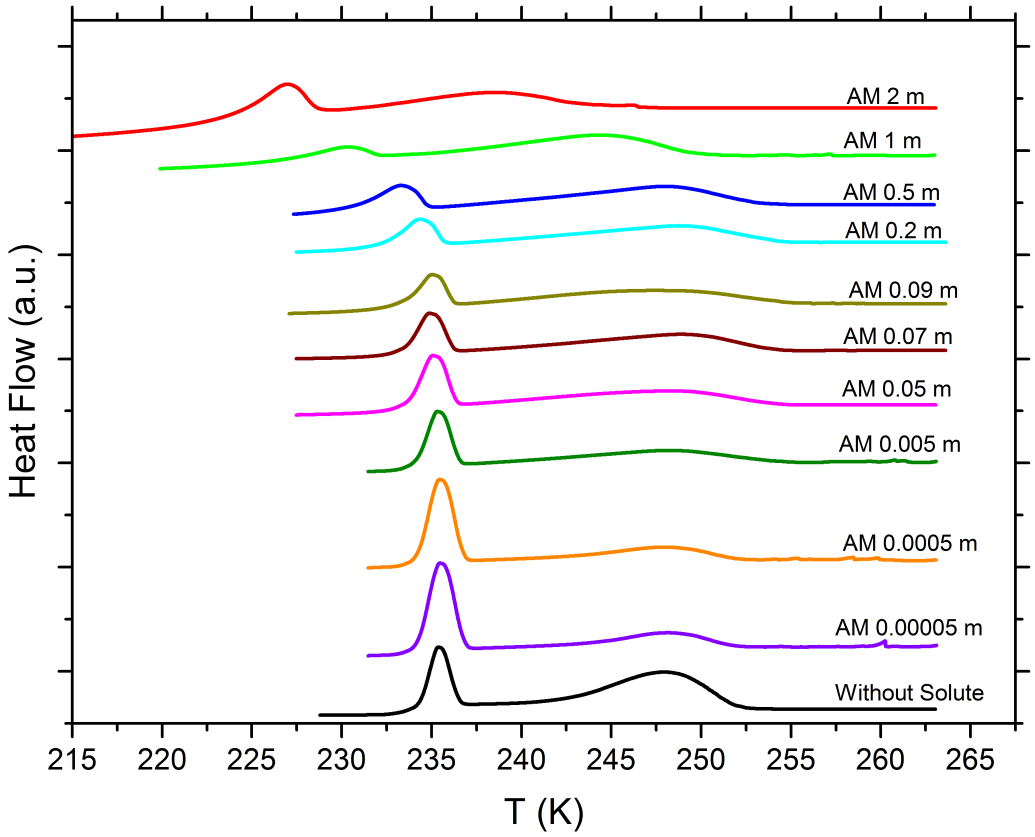


**Figure S4.** DSC thermograms of 2 wt% of microcline particles suspended in ammonia solution (AM) solution droplets of varying concentration. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value. Numbers next to each curve: Solute Concentration (in molal) AM: Ammonia

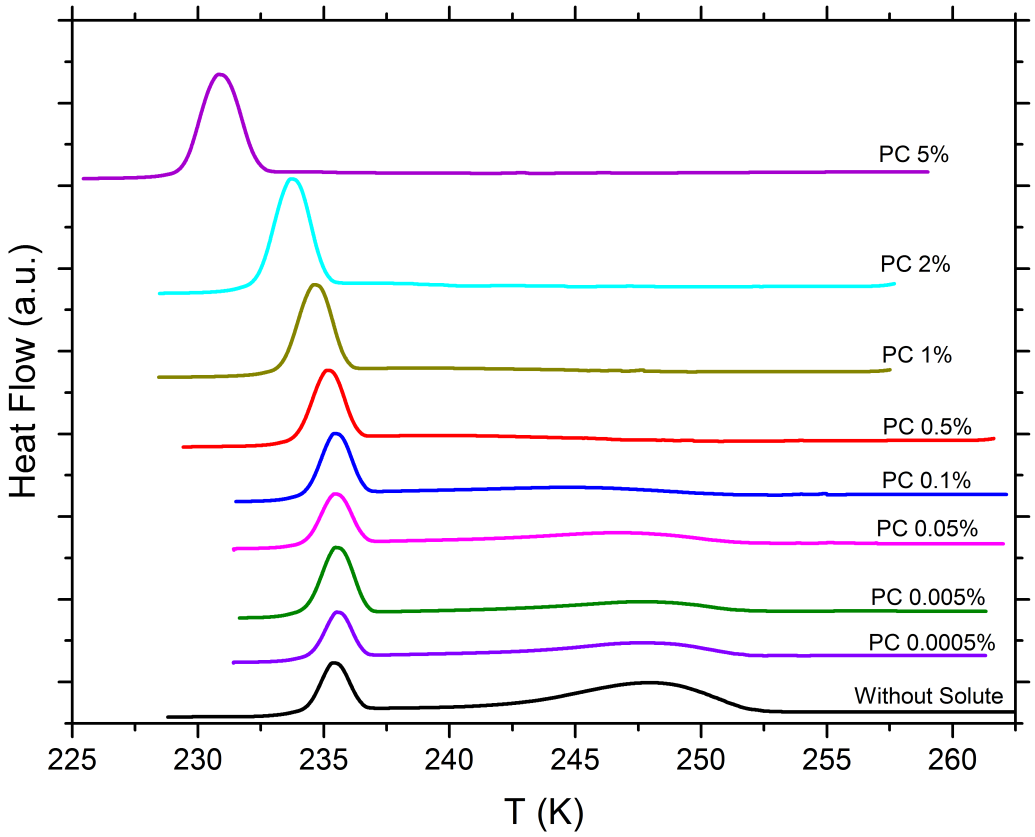


**Figure S5.** DSC thermograms of 2 wt% of microcline particles suspended in potassium chloride (PC) solution droplets of varying concentration. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value. Numbers next to each curve: Solute Concentration (in wt%) PC: Potassium Chloride

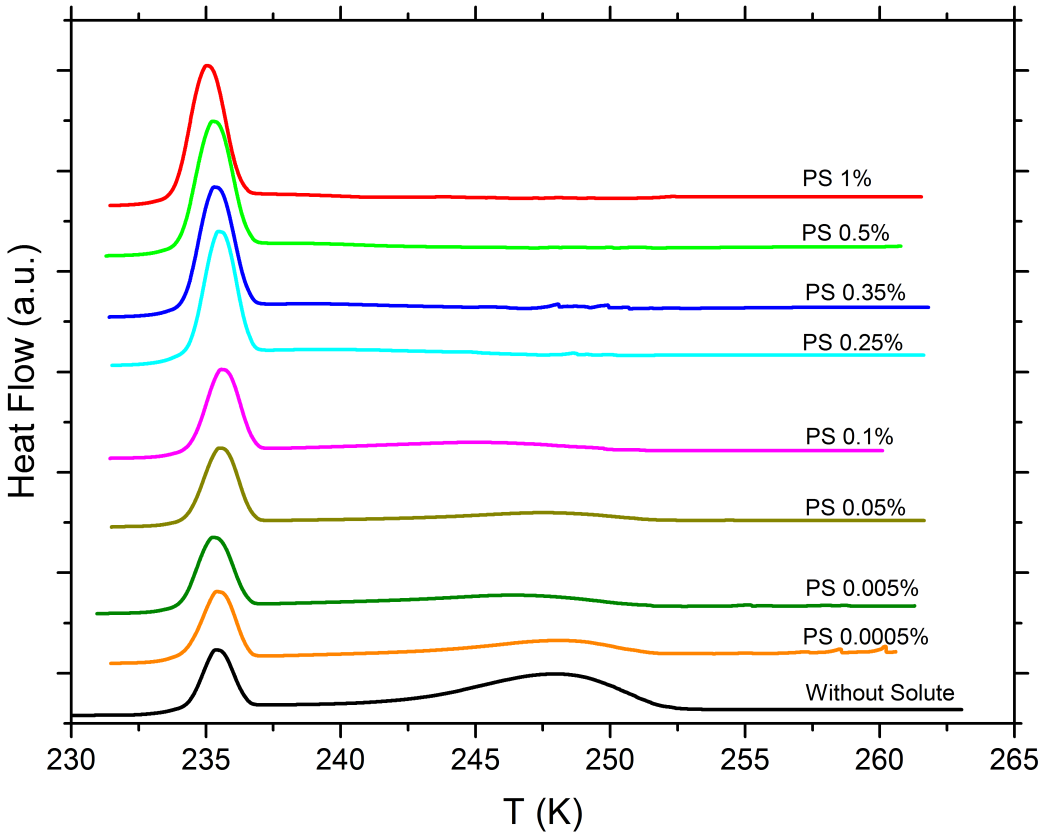


**Figure S6.** DSC thermograms of 2 wt% of microcline particles suspended in potassium sulfate (PS) solution droplets of varying concentration. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value. Numbers next to each curve: Solute Concentration (in wt%) PS: Potassium Sulfate

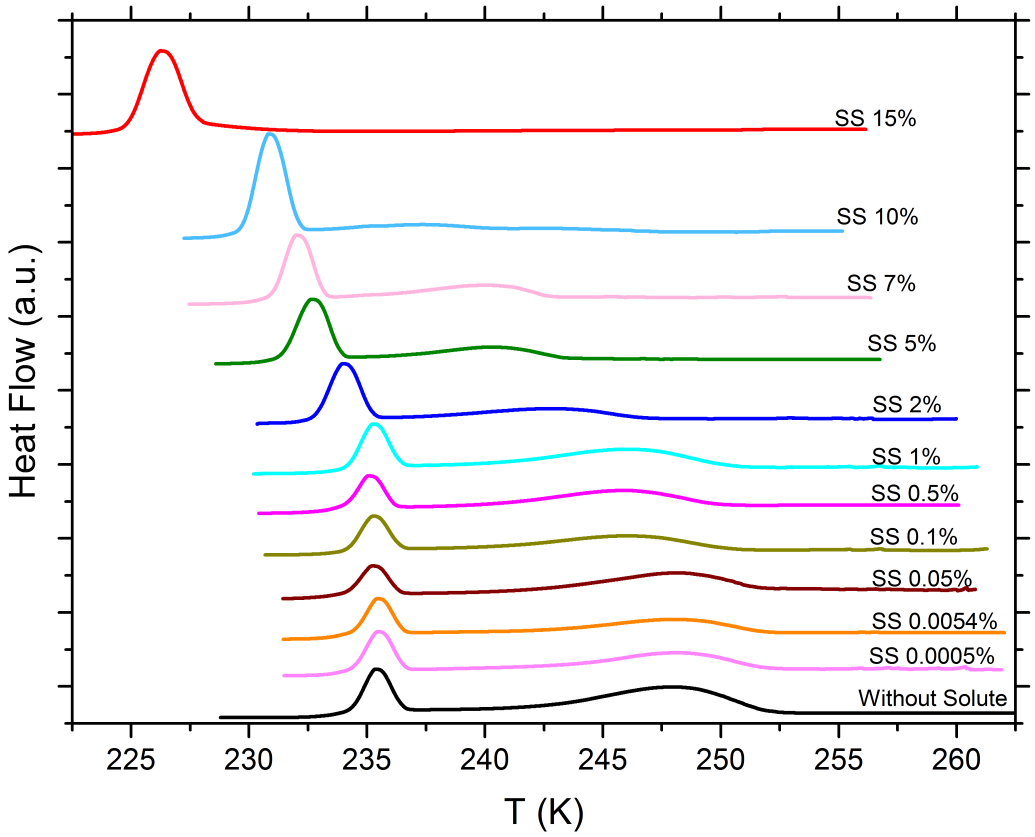


**Figure S7.** DSC thermograms of 2 wt% of microcline particles suspended in sodium sulfate (SS) solution droplets of varying concentration. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value. Numbers next to each curve: Solute Concentration (in wt%) SS: Sodium Sulfate

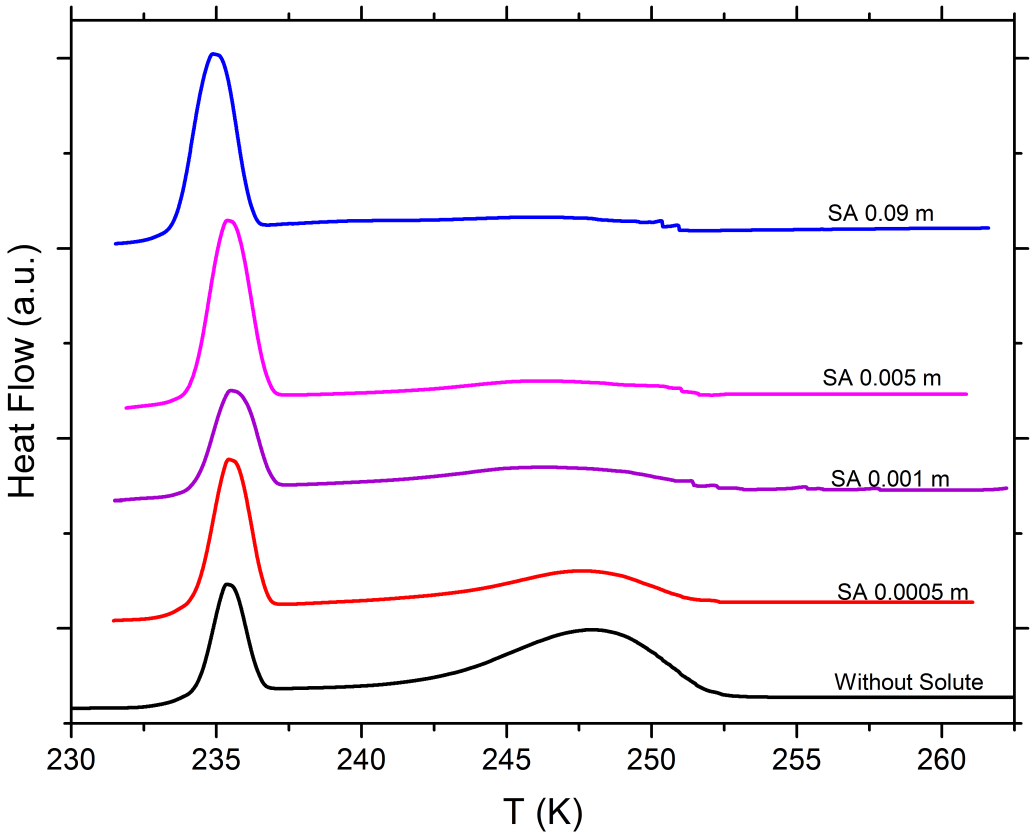


**Figure S8.** DSC thermograms of 2 wt% of microcline particles suspended in sulfuric acid (SA) solution droplets of varying concentration. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value. Numbers next to each curve: Solute Concentration (in molal) SA: Sulfuric Acid

**S2 Immersion freezing experiments with microcline emulsions as a function of aging**

Microcline (2 wt%) suspended in pure water, ammonia solution (0.05 molal), and ammonium sulfate solutions (0.1 wt% and 10 wt%) were aged over a period of one week. Immersion freezing experiments were carried out with the DSC setup on the day of preparation (fresh), then on the first, fourth and seventh day after preparation in order to assess the long-term effect of ammonia and ammonium containing solutes on the IN efficiency of microcline. We show the DSC thermograms (1 K $min^{-1}$ cooling cycle) for each solute concentration over the measured time period.

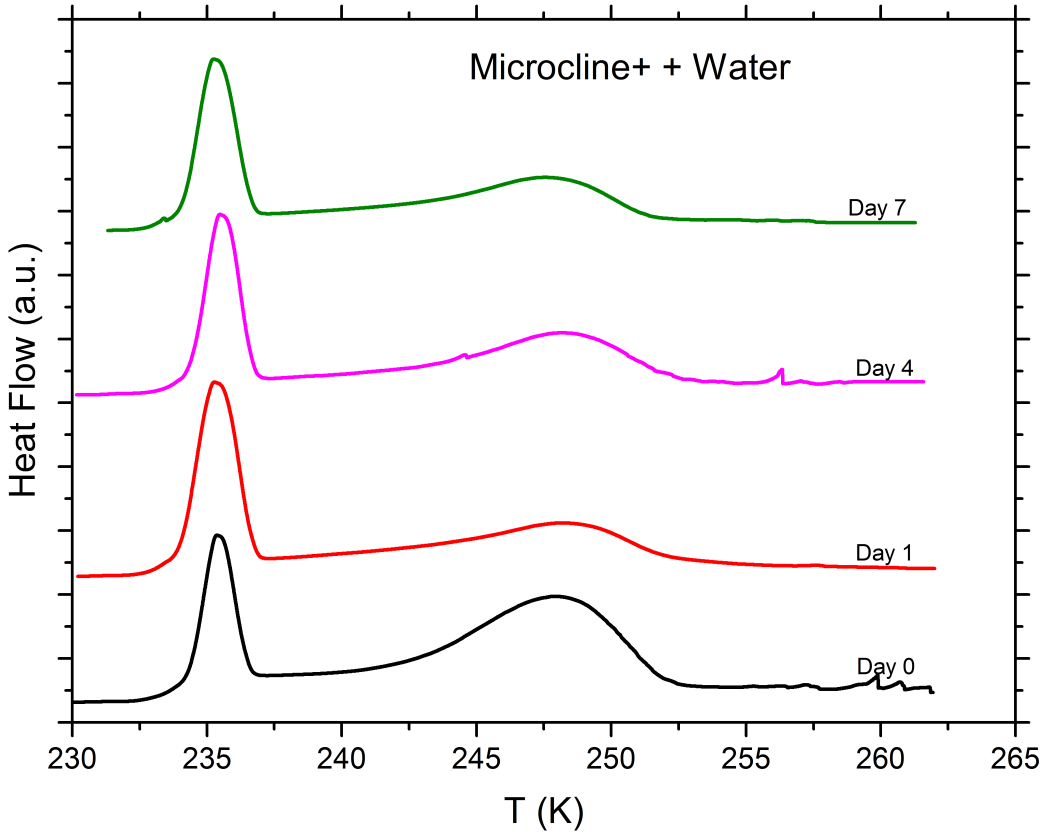


**Figure S9.** DSC thermograms of aging tests with 2 wt% of microcline particles suspended in pure water droplets measured over a period of one week. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value.

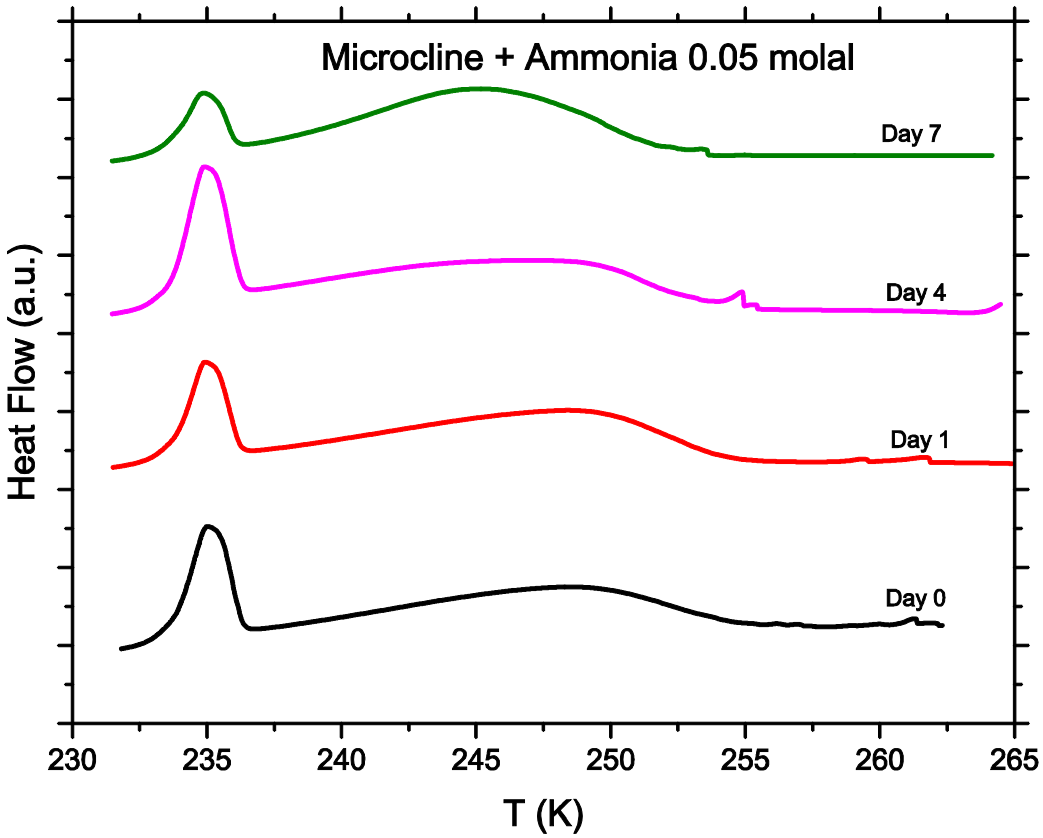


**Figure S10.** DSC thermograms of aging tests with 2 wt% of microcline particles suspended in ammonia (0.05 molal) solution droplets measured over a period of one week. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value.

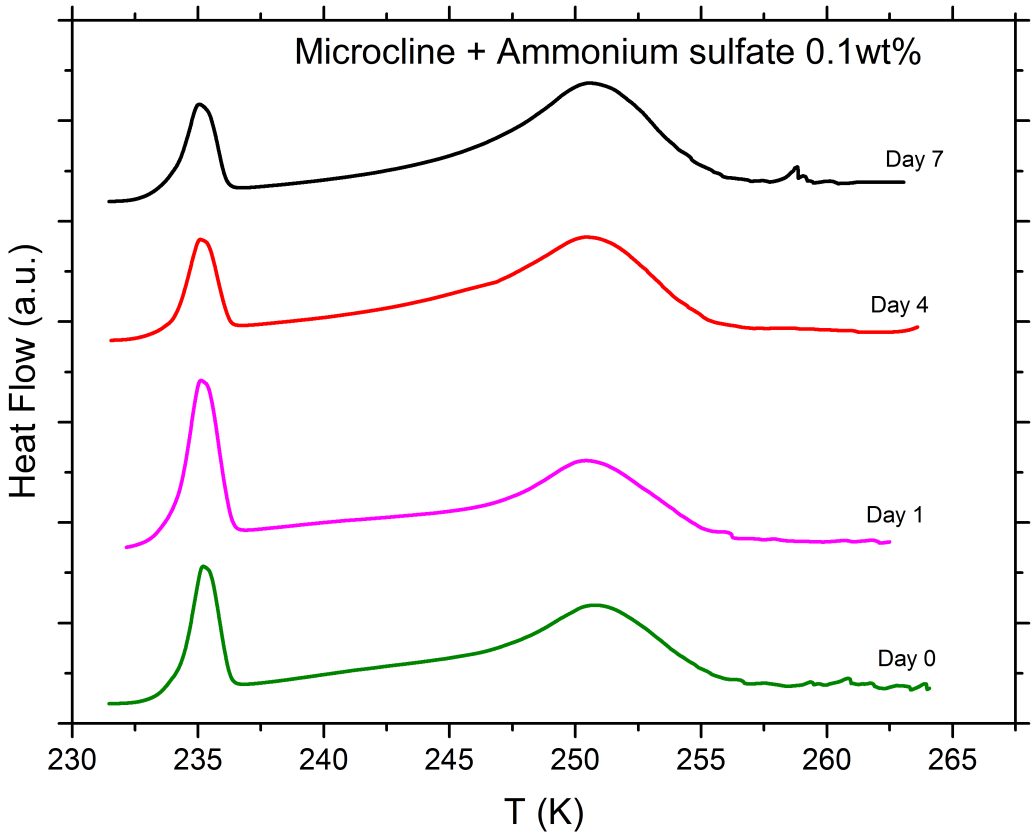


**Figure S11.** DSC thermograms of aging tests with 2 wt% of microcline particles suspended in ammonium sulfate (0.1 wt%) solution droplets measured over a period of one week. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value.

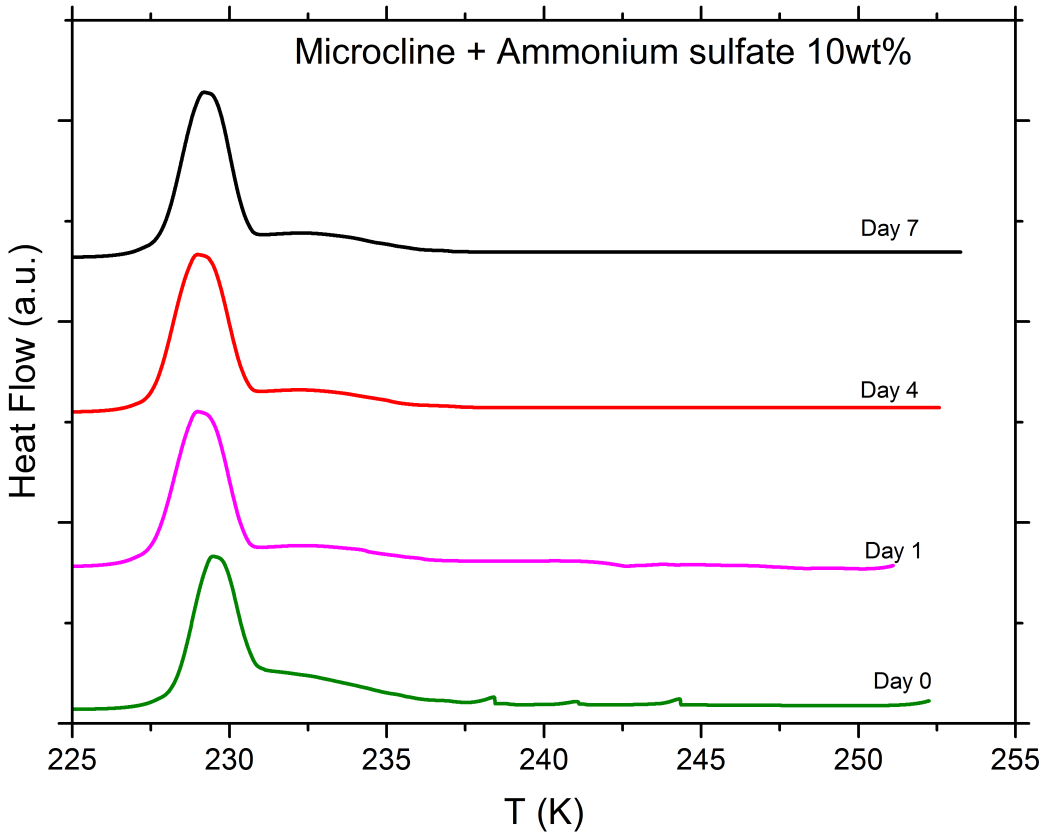


**Figure S12.** DSC thermograms of aging tests with 2 wt% of microcline particles suspended in ammonium sulfate (10 wt%) solution droplets measured over a period of one week. All curves are normalized such that the areas under the heterogeneous and homogeneous freezing curves sum up to the same value.

**S3 Reversibility of interactions between microcline and solutes tested in immersion freezing experiments**

Suspensions of 2 wt% microcline prepared with relatively high solute concentration — 10 wt % $(NH_4)_2SO_4$, 2 wt % $NH_4HSO_4$, 0.5 wt % $K_2SO_4$, 2 molal ammonia solution — were aged for 10 days. The aged suspensions were then centrifuged and the particles were washed multiple times with pure water. The aged particles were resuspended either in pure water or in dilute solution of the same solute as in the beginning (i.e. water, 0.1 wt % $(NH_4)_2SO_4$, 0.5 wt % $NH_4HSO_4$, 0.05 wt % $K_2SO_4$, 0.05 molal $NH_3$ solution). Using DSC, we compared immersion freezing of emulsions containing dust treated in this manner with emulsions of the same solute concentration prepared with fresh dust. Each measurement was done in duplicates. The following figures show one set of DSC thermograms (1 K $min^{-1}$ cooling cycle) for the treated particles resuspended either in pure water or in dilute solution of the same solute used for aging.

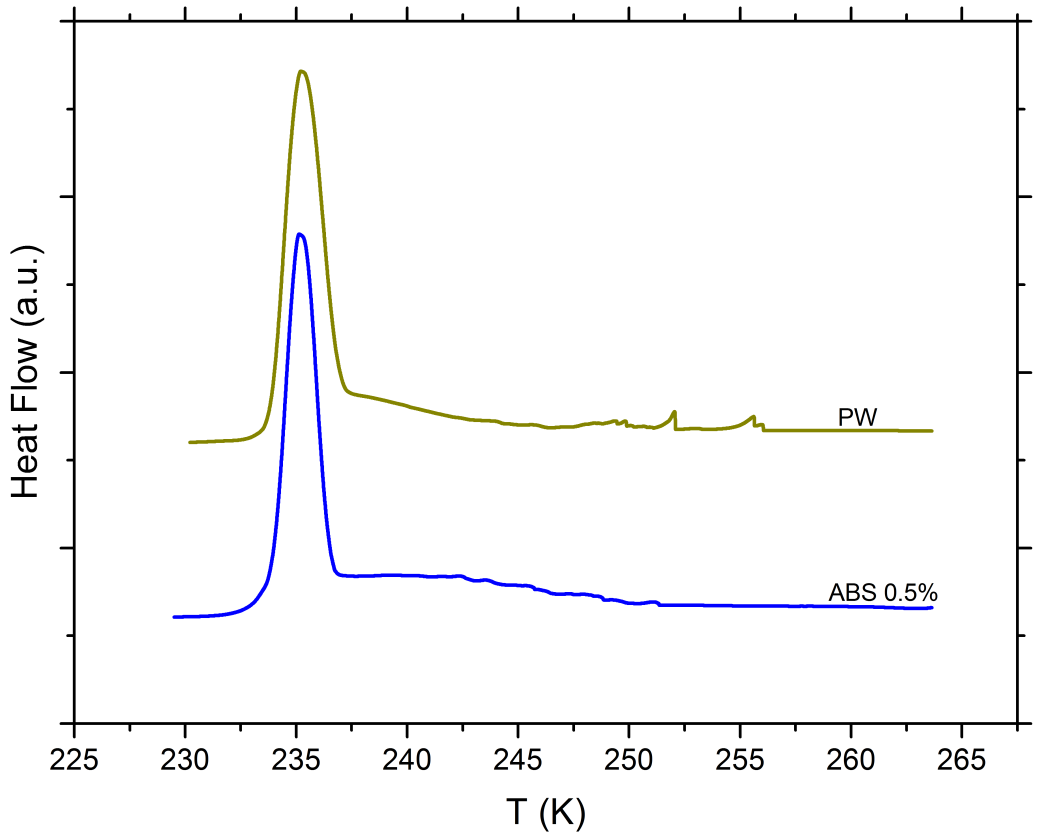


**Figure S13.** DSC thermograms of aged microcline resuspended in pure water (PW) and ammonium bisulfate (ABS) 0.5wt%. Aging Solution: 2 wt% Ammonium Bisulfate. Aging Period: 10 days.

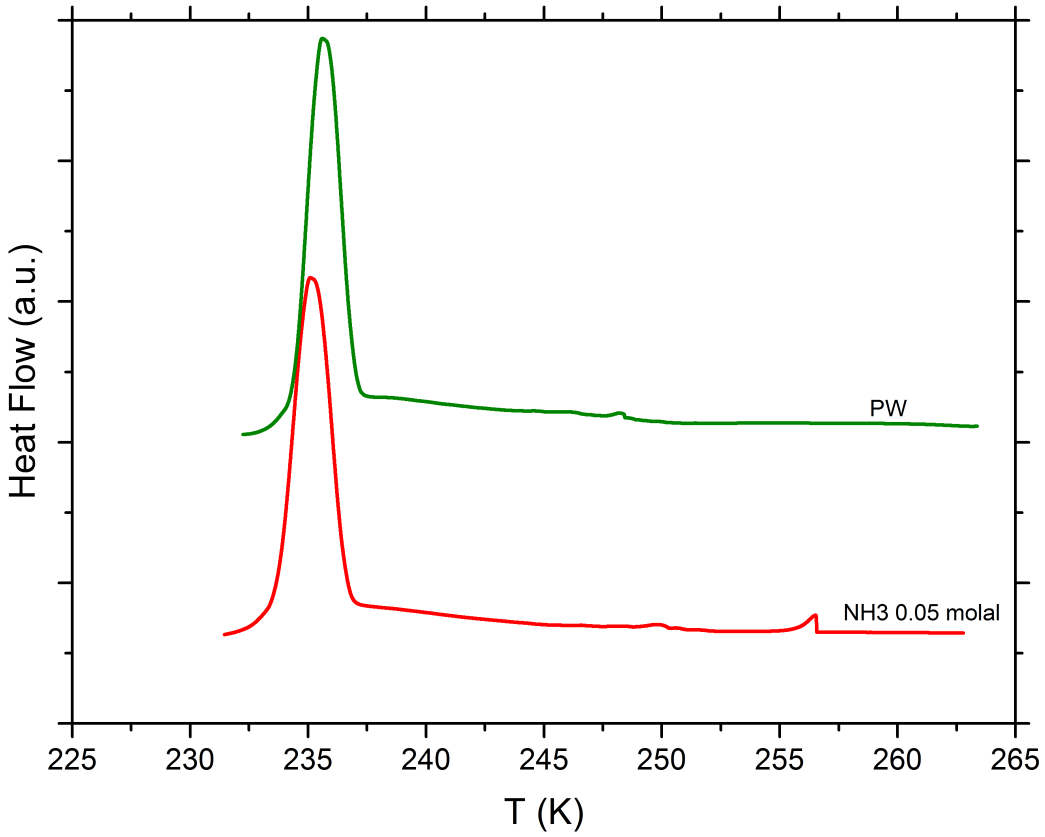


**Figure S14.** DSC thermograms of aged microcline resuspended in pure water (PW) and ammonia solution (NH3) 0.05 molal. Aging Solution: ammonia solution 2 molal. Aging Period: 10 days.

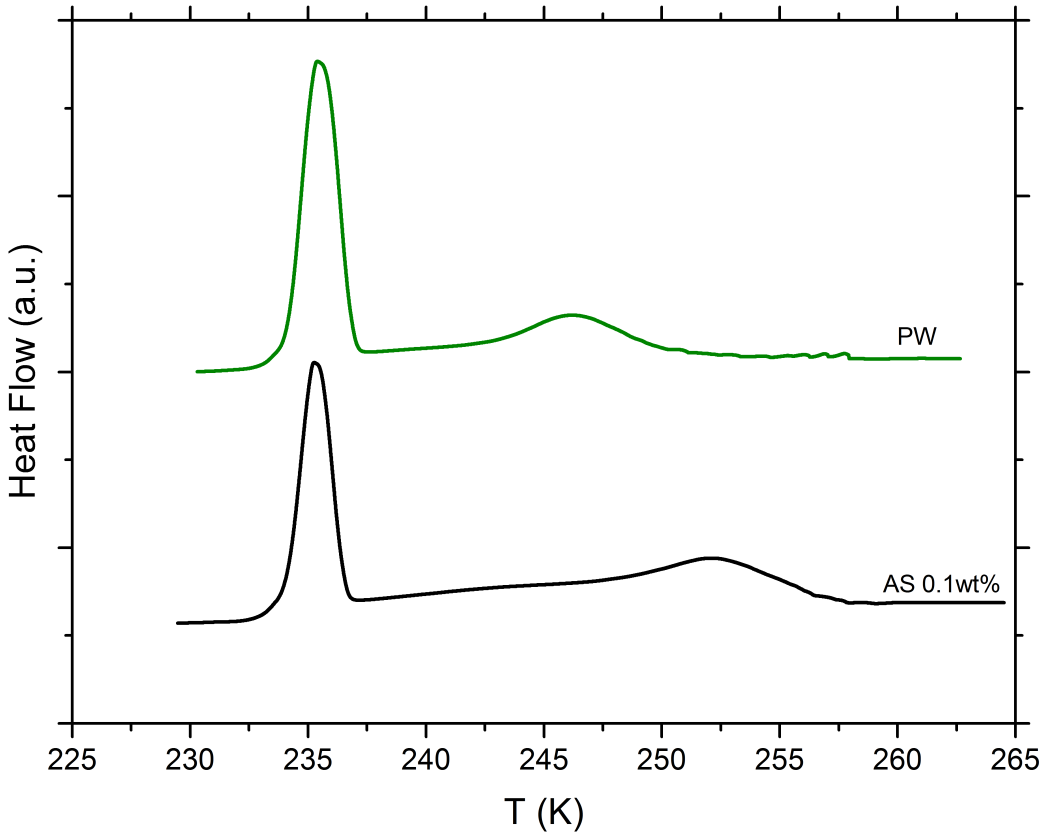


**Figure S15.** DSC thermograms of aged microcline resuspended in pure water (PW) and ammonium sulfate (AS) 0.1wt%. Aging Solution: 10 wt% Ammonium Sulfate. Aging Period: 10 days.

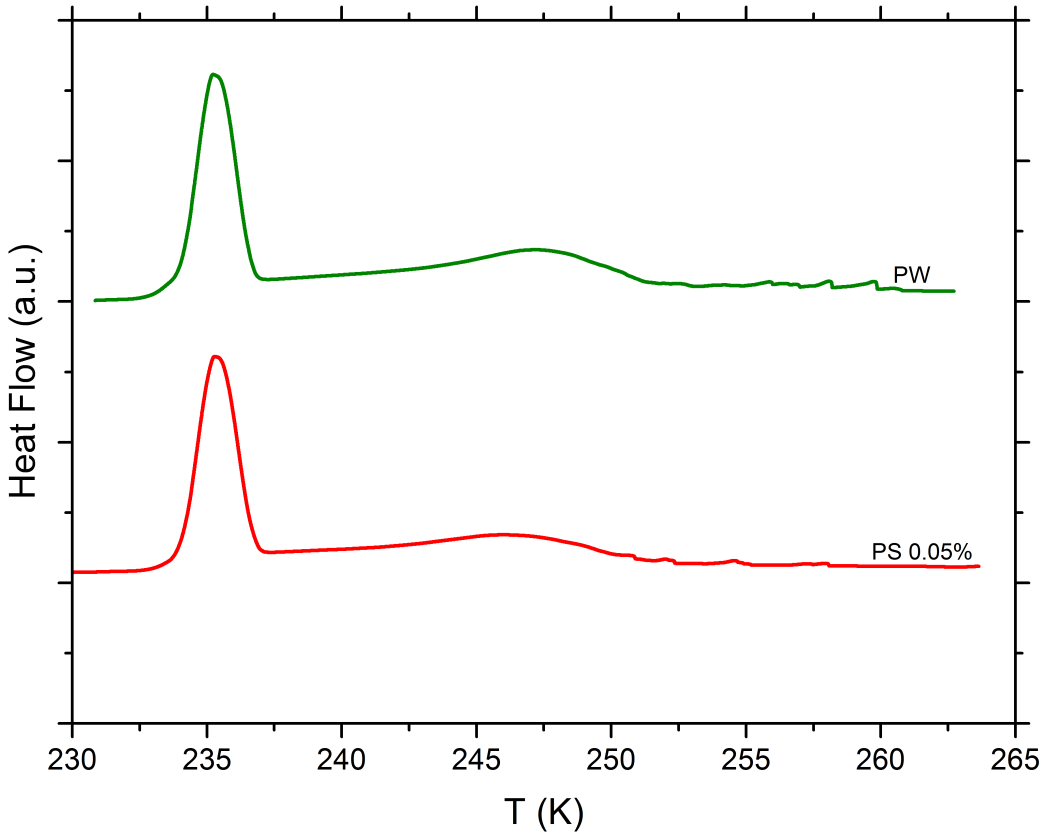


**Figure S16.** DSC thermograms of aged microcline resuspended in pure water (PW) and potassium sulfate (PS) 0.5wt%. Aging Solution: 0.5 wt% Potassium Sulfate. Aging Period: 10 days.

**S4 Particle size distribution of microcline**

Number size distribution of milled microcline sample was obtained with a TSI 3080 scanning mobility particle sizer (SMPS) and a TSI 3321 aerodynamic particle sizer (APS), and merged as described by Beddows et al. (2010). The dry particles were dispersed using a fluidized bed. A lognormal distribution was fitted to the size distribution yielding a mode diameter of 213 nm.

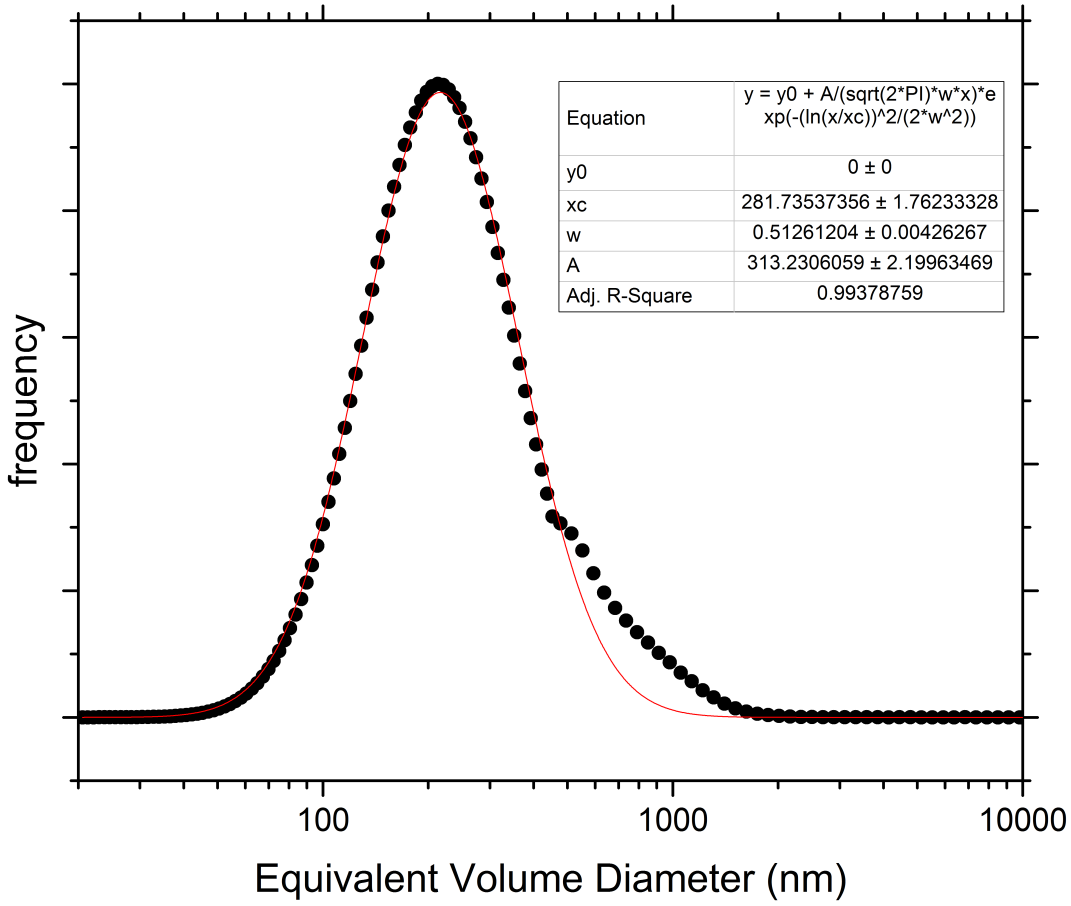


**Figure S17.** Particle size distribution of microcline sample.