Supplementary Information
Structure, dynamics and phase transitions in electric field assembled colloidal crystals and glasses

Indira Barros[1], Sayanth Ramachandran[2,1], and Indrani Chakraborty*[1]

[1]Department of Physics, Birla Institute of Technology and Science, Pilani–K K Birla Goa Campus, Zuarinagar, Goa 403726, India
[2]Max-Planck Institute for Polymer Research Mainz, Ackermannweg 10, 55128 Mainz, Germany

1 Videos

Video V1: Formation of colloidal crystals for 1 μm polystyrene particles in a solution containing 10^{-5} M NaCl (ζ=−102.8 mV) when subject to an AC electric field of 5 kHz and 20 Vpp perpendicular to the viewing plane. The video is 2x sped up.

Video V2: The (3x sped up) video shows the changes in the structural configuration of the colloidal crystals as the frequency is changed. At 10 kHz the structure is completely disordered. As the frequency is decreased, the formation of crystalline zones is seen, leading to maximum crystallization at 5 kHz. Beyond this a decrease in the frequency leads to breaking up of these zones to form an open (non close-packed), disordered structure at 1 kHz. The peak-to-peak voltage was fixed at 20 Vpp and the frequency was changed in steps of 1 kHz every 10 seconds.

2 Figures

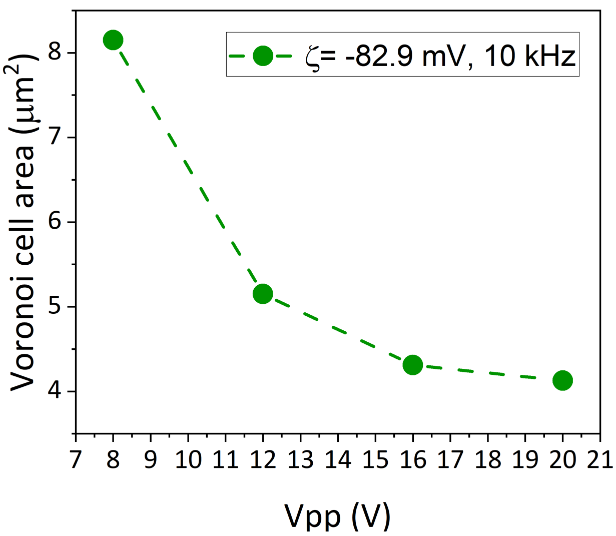

Figure **S1**: A plot of the Voronoi cell area $\langle A \rangle$ as a function of the applied peak to peak voltage Vpp at a frequency of 10 kHz and ζ=−82.9 mV. $\langle A \rangle$ shows a decreasing trend with an increase in Vpp, indicating more close-packed crystals.

*Email: indranic@goa.bits-pilani.ac.in

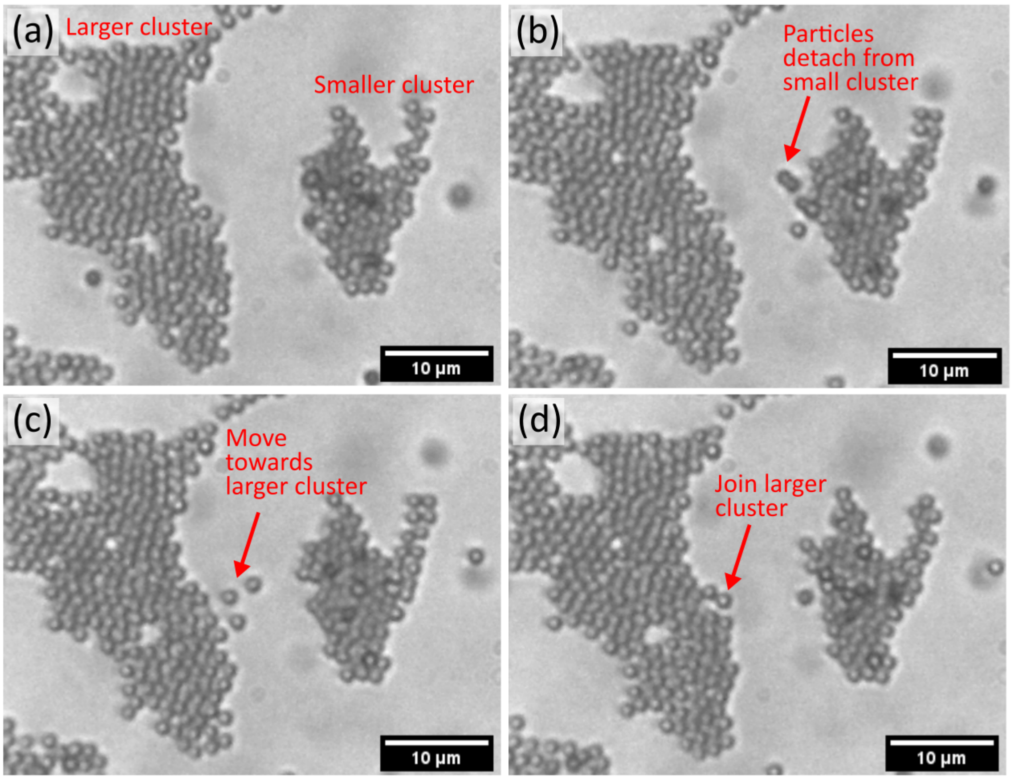

Figure **S2**: Particles from a smaller clusters are seen to detach and join larger ones, allowing for its rapid growth and formation of large areas of crystallinity with time.

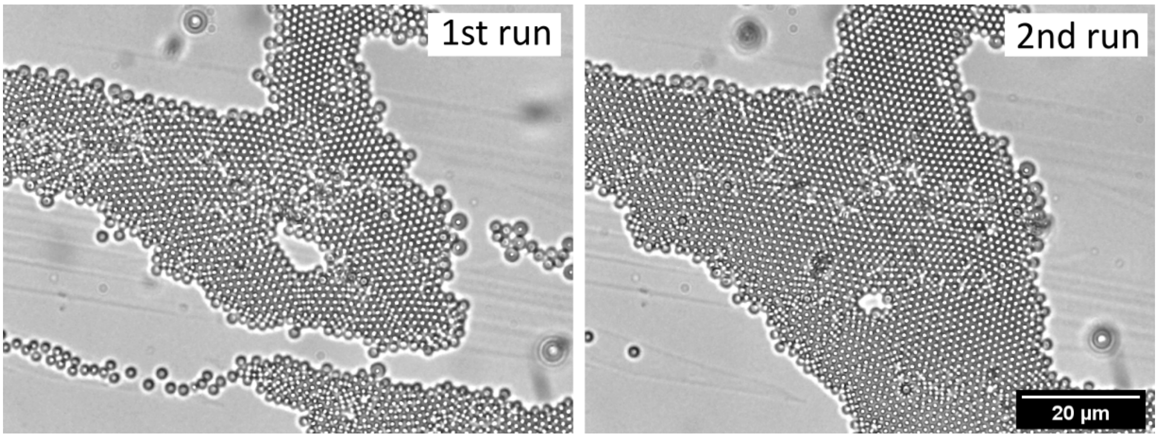

Figure **S3**: Successive crystal formation and destruction using frequency sweeps produces more perfect crystals. While in the 1st run, several defects and dislocations are observed (left picture), in the second run, there is a greater degree of defect-free crystalline zones (right picture)

.

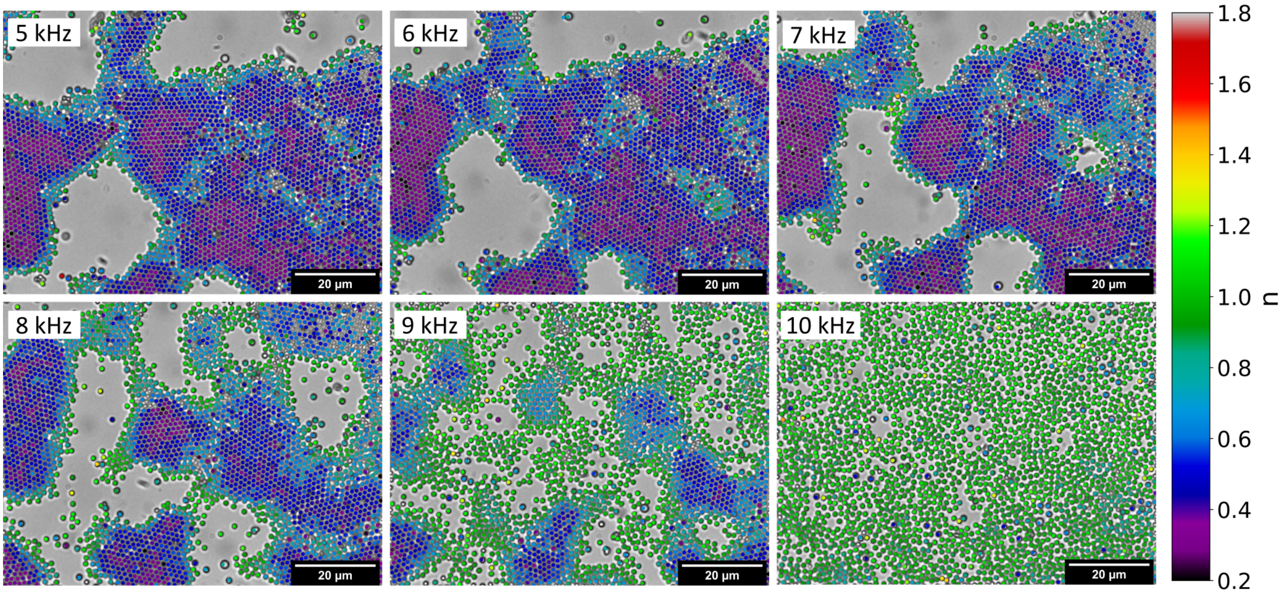

Figure **S4**: Coloumap images representing showing the variation of the diffusion exponent n as the gradual destruction of crystalline order occurs with an increase in frequency from 5 kHz to 10 kHz. While at 5 kHz a large number of particles in the inner regions exhibit $n < 1$ indicating subdiffusion, the dynamics is almost purely Brownian ($n = 1$) at 10 kHz.