Relaxation in jammed monolayers of elongated particles

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The relaxation in systems of elongated particles (discorectangles) adsorbed on a plane was studied numerically. The initial jamming state was formed using the random sequential adsorption (RSA) model. The off-lattice model was used. The aspect ratio of particles (length-to-width ratio) was varied within the range ε=1÷13. After formation of jamming state it was relaxed via translational and rotational Brownian motions.

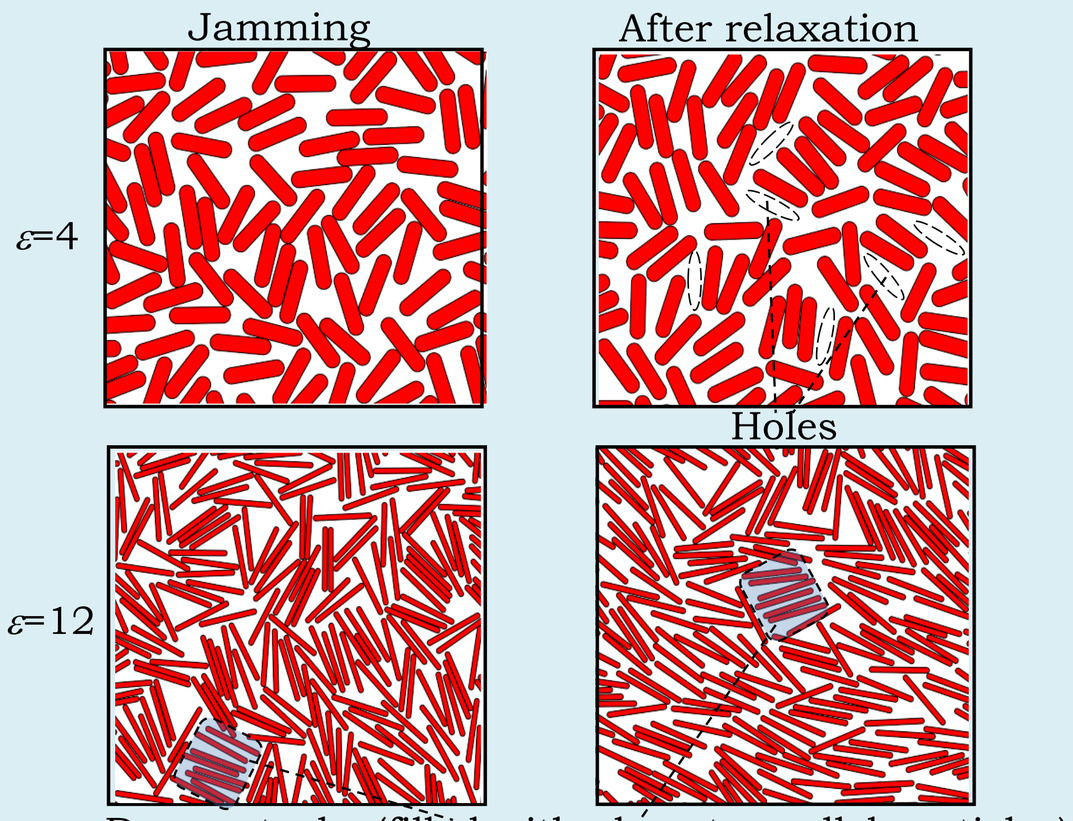

Figure 1: Patterns in a jamming state and after complete relaxation for particles with aspect ratio ε=4 and ε=12.

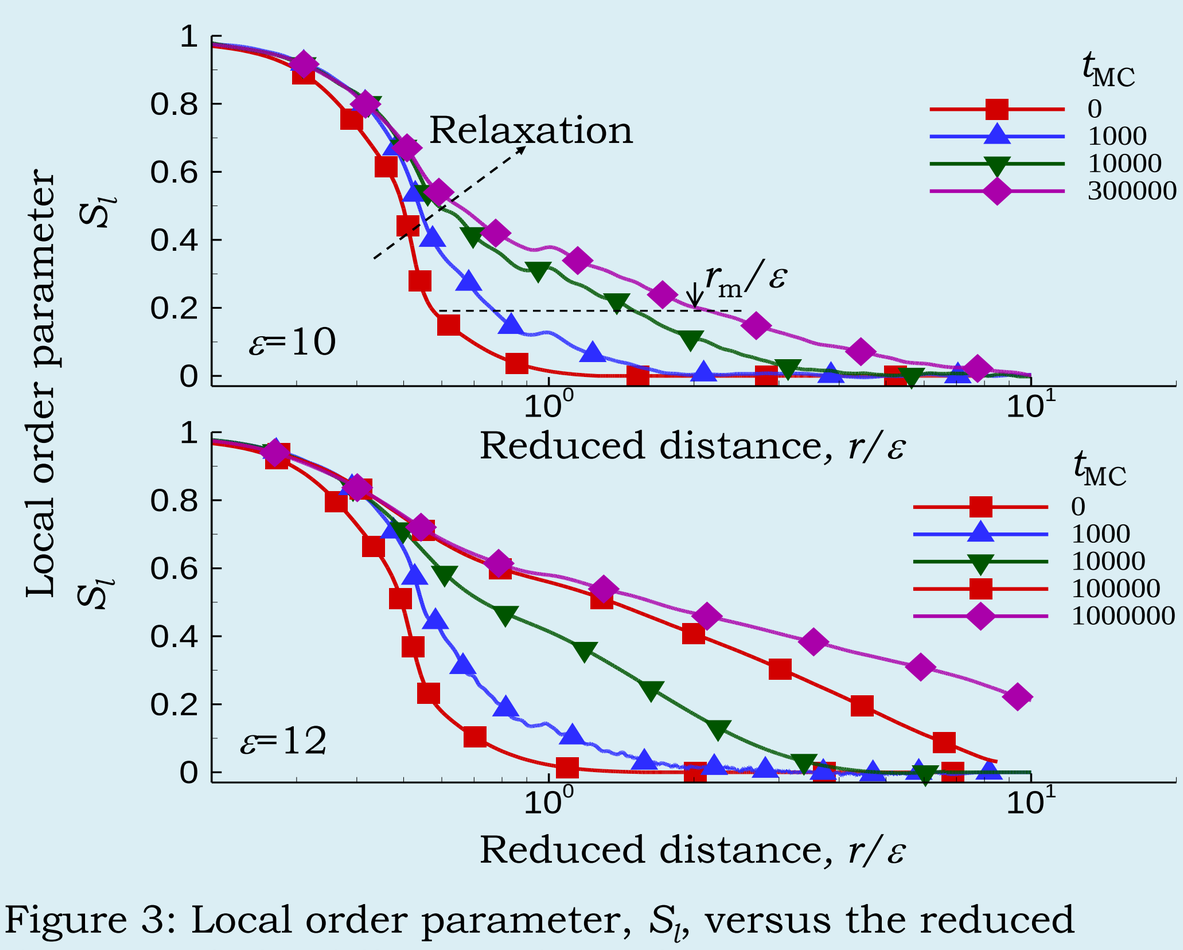

Figure 3: Local order parameter, S_l, versus the reduced distance r/ε for different values of t_{MC}.

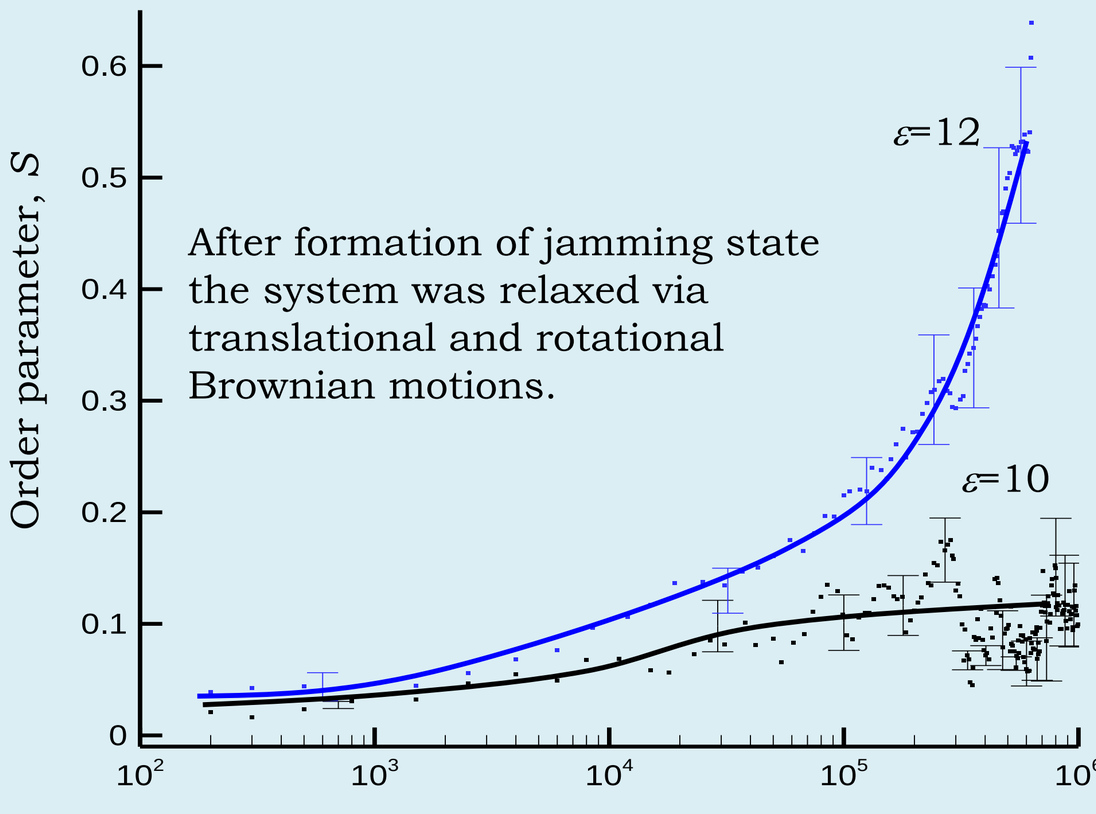

Figure 2: Order parameter, S, versus the time, t_{MC}, during the relaxation for particles with aspect ratio ε=4 and ε=12.

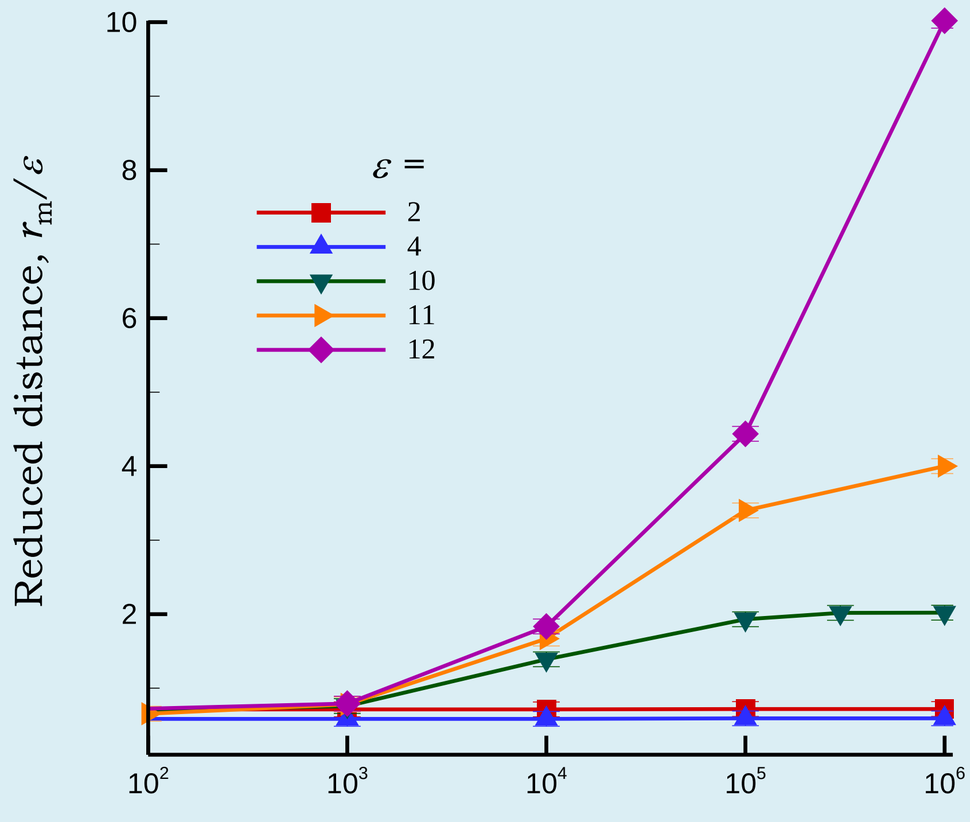

Figure 4: Reduced distance, r_m/ε, versus the time, t_{MC}, for different values of aspect ratio, ε.

Conclusions

For systems with relatively small aspect ratios ($\varepsilon \leq 9$) the relaxation into the isotropic state with S=0 was always observed. In the intermediate range, $9<\varepsilon\leq12$, the relaxation into the isotropic or nematic phase was observed. In systems with higher aspect ratio ($\varepsilon>12$), the relaxation into the nematic phase was always observed. The transition to the nematic phase occurs due to the enlargement and consolidation of stacks of particles.

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