

Formation and Deformation of Polymeric Soft Colloidal Crystalline Latex Film

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Polymeric latex dispersions are widely used as paint, paper coating, and water based adhesive. They are applied as liquid dispersions and form a mechanically stable film upon drying. Latex particles usually pack in a face-centered cubic (fcc) structure and assume a dodecahedral shape in the film. The thus formed colloidal crystalline latex film can undergo large crystallographic deformation upon mechanical treatment. We use synchrotron small angle X-ray scattering (SAXS) technique to study such structural transition and post film formation structural evolution during tensile deformation. A commercially available styrene/n-butyl acrylate copolymer ($T_g=20\text{ }^\circ\text{C}$) latex dispersion (average particle diameter 118 nm) was used in the experiments. In case of drying a latex droplet, the resulting solid material exhibits a multi-domain structure of randomly oriented close-packed colloid fcc crystallites [1]. A directional drying of the latex dispersion in a tube of 2 mm diameter yields a highly uniaxially orientated fcc crystallites [2]. We investigated the deformation mechanism of latex films with isotropic polycrystalline structure [3,4] and with fiber symmetric crystalline structure [5] subjected to uniaxial stretching. The soft colloidal crystalline latex film exhibits peculiar crystallographic deformation behavior, namely much larger changes in crystalline lattice constant during stretching than atomic or molecular crystals. The underlying deformation mechanism was also considered based on in-situ synchrotron SAXS measurements.

References

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