AFM observation of microparticle latex film under tensile strain

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The behavior of materials under mechanical stress is a crucial consideration when designing new materials for a sustainable environment. Thus, the emergence of waterborne microparticle latex films has garnered significant attention due to their outstanding mechanical stability and environmental sustainability[1]. Although macro-scale testing devices have advanced our understanding of latex films, the lack of microscopic observation hinders our comprehension of their breakage mechanisms, potentially limiting further improvements. Atomic force microscopy (AFM) is widely used in materials and surface science due to its exceptional spatial resolution and flexible observation conditions. In this study, we incorporate a uniaxial stretching device into a tip-scan type AFM[2] to demonstrate its applicability through the observations of polymeric microparticle latex films under various strains up to 60%. The results reveal that the latex film experiences a variety of transformations under applied strain, including particle deformation, interparticle separation, and domain rearrangement. These behaviors suggest that the mechanical properties of the latex film are not only complex but can also be optimized during the manufacturing process. This insight opens up new avenues for tailoring material performance to achieve various objectives.

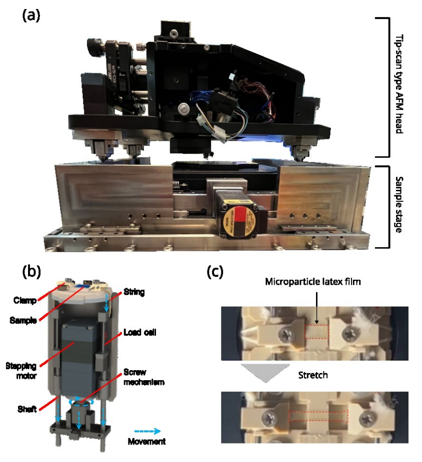

Fig. 1 (a) Photo of developed AFM. (b) Rendering of the stretching device. (c) Stretching motion of (b).

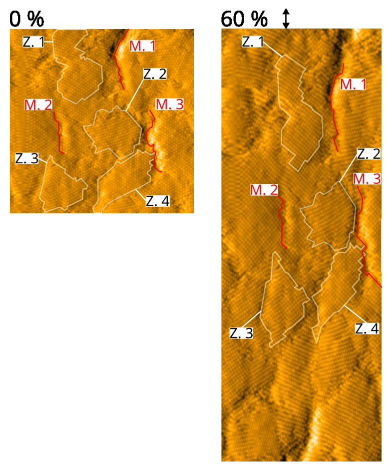

Fig. 2 Comparison of latex film surface under 0% and 60% strain.

References

[1] Y. Sasaki et al., *Langmuir*, **39** (2023), 9262-9272

[2] F.-Y. Chan et al., *Rev. Sci. Instrum.* **93**, 113703 (2022).