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Ultrasonic Vibration Imposed on Thin Liquid Solution Films as an Effective Tool for Improved Characteristics of Ensuing Thin Solid Films MORTEZA ESLAMIAN, FATEMEH ZABIHI, AMIN RAHIMZADEH, QIN WANG, MEHRAN HABIBI, YU XIE, University of Michigan-Shanghai Jiao Tong University Joint Institute — Thin solid films have ubiquitous presence in various existing and emerging technologies. Solution-processed thin solid films may be fabricated by casting a liquid solution film followed by a drying step. We have developed a method in which by imposing ultrasonic vibration on the substrate, characteristics of the resulting thin solid films and the performance and reproducibility of the ensuing thin film devices, such as perovskite and polymer solar cells, are improved. To explain this, we have studied the evolution of thin liquid films, subjected to ultrasonic vibration. It is found that the vertical vibration tends to destabilize the thin liquid film, however, in low-amplitude ultrasonic vibration, the term contributing to the perturbation growth rate due to vibration, decays rapidly. Vertical vibration is found as a destabilizing force, only if the film thickness is near a critical thickness in which the destabilizing van der Waals and stabilizing gravity and surface tension forces balance one another. It is substantiated that the lateral vibration does not promote instability. In summary it is found that while imposing ultrasonic vibration may destabilize and breakup the thin liquid film, a mild and controlled vibration significantly improves the homogeneity and uniformity of the ensuing thin solid film.

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