Controllable formation of large-area colloidal particle multilayers at the air-water interface with the help of depletion attraction

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Herein, we report a new simple approach for achieving and controlling large-area particle multilayers at the air-water interface. Specifically, under the compression of hydrophilic particle monolayers in the presence of depletion attraction, the colloidal particle multilayers with a significantly large-area can be formed at the collapse state, and their vertical height and lateral size are even simply controlled by adjusting the concentration of depletant in the water phase and the compressional distance, respectively. Furthermore, by compressing the monolayer of particles of the binary mixture with quite different surface wettability, asymmetric particle multilayers can be simply achieved as well, and their lateral size and the vertical height are also easily controlled by changing the fraction of the binary particle mixture and the way to spread particles onto the interface.