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Commensurate-incommensurate solid transition in the ^{4}He monolayer on a single γ-graphyne sheet YONGKYUNG KWON, JEONGHWAN AHN, School of Physics, KonKuk University, Korea — We have performed path-integral Monte Carlo calculations to study ^{4}He adsorption on γ-graphyne. Assuming the ^{4}He-substrate interaction described by a pairwise sum of empirical helium-carbon interatomic potentials, we find that unlike α-graphyne [1], a single sheet of γ-graphyne is not permeable to ^{4}He atoms despite its large surface area. One-dimensional density distribution shows layer-by-layer growth of ^{4}He on γ-graphyne. Partially-filled ^{4}He monolayers are found to exhibit different commensurate structures depending on the helium coverage; it shows a $C_{2/2}$ commensurate structure at the areal density of 0.0491 Å^{-2}, a $C_{3/2}$ structure at 0.0736 Å^{-2}, and a $C_{4/2}$ structure at 0.0982 Å^{-2}. After going through various domain structures, the ^{4}He monolayer is completed at the areal density of 0.115 Å^{-2} where ^{4}He adatoms form an incommensurate triangular solid. Possible superfluid response of the ^{4}He monolayer on γ-graphyne is now under investigation.

[1] Y. Kwon, H. Shin, and H. Lee, Phys. Rev. B **88**, 201403(R) (2013).

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