

Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

The STM investigations of hydrogenation on monolayer silicene with $r7 \times r7$ superstructure LAN CHEN, Institute of Physics, The Chinese Academy of Sciences — The early investigations revealed the monolayer silicene with $r7 \times r7$ superstructure on Ag(111) can extend over the whole substrate. But this phase was considered to be highly defective due to the strong strain, which limit the applications of this phase. In this presentation, I will report our works about the hydrogenations on the monolayer silicene with $r7 \times r7$ superstructure on Ag(111) by scanning tunneling microscopy (STM). The STM images show the ordered structures with lattice identical to silicene- 1×1 unit cell after hydrogenation on silicene at room temperature, which reveals that the original silicene with $r7 \times r7$ superstructure is an ideal defectless single-crystal monolayer film. Combined with density functional theory calculations, the structures of hydrogenation can be explained by the “sub-lattice adsorption-picture,” in which H atoms only adsorb on Si atoms in one sub-lattice of silicene. Moreover, by annealing to a moderate temperature, about 450 K, de-hydrogenation process occurs and the clean silicene with $r7 \times r7$ superstructure can be fully recovered.

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Date submitted: 14 Nov 2014

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