Investigating the interfacial properties of graphene with traditional semiconductors is crucial to developing of novel electronics [1]. In this framework, Graphene/Ge(110) has received a great deal of attention recently, especially over the last couple of years [2–7]. However, a detailed picture of the structural and electronic properties of this interesting system is today still unavailable. Here, combining scanning tunneling microscopy (STM) and angle-resolved photoemission spectroscopy (ARPES) experiments with density functional theory (DFT) simulations, we unveil the interfacial properties of Graphene/Ge(110). In more details, we show that temperature-triggered structural changes at the interface strongly modify graphene's doping level. After growing graphene by chemical vapor deposition (CVD), the Ge surface results in being passivated by hydrogen that was present in the growth atmosphere [5]. ARPES results show that at this stage graphene is p-doped. The sample is then annealed in vacuum, at a temperature above 350 °C, leading to desorption of hydrogen and subsequent reconstruction of the Ge surface into the (6x2) phase. Here, we find from ARPES data that graphene is interacting more weakly with the Ge substrate, and is now close to an undoped state. Upon higher-temperature annealing, the Ge surface further modifies [2]. Our ARPES data reveals a stronger interaction between graphene and Ge, and graphene results now in being n-doped. To gain more insights into this fascinating system, we simulate the cases of as-grown and hightemperature annealed samples. Accounting for the presence of thermally generated acceptor-type defects in Ge [8-9our model successfully predicts the experimental ARPES data. Interestingly, when simulating the sample after high temperature annealing, we observe that locally some of the Ge atoms in the surface rearrange, thus creating a certain degree of disorder. Such disorder, in addition to many thermally induced vacancies, is indeed confirmed by STM investigation.

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