The effect of impurities (as O and In) on hysteresis and phase transition of In/Si(111)-4\times1 surface

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In/Si(111)-4\times1 surface is known to quasi-1D metallic chain at room temperature and transform into insulating 8\times2 phase at low temperature [1]. The transition order as well as its nature has been heavily debated. Recently, a study using ultrafast electron diffraction with optical excitation suggested that the transition is of the first order [2]. To test its contention, we carried out low-energy electron diffraction (LEED) experiment. We observed the hysteresis in the 4\times1-8\times2 structural transition of the In/Si(111) surface, which is more direct evidence for the first-order transition. By introducing oxygen and indium adsorbates on the In/Si(111)-4\times1 surface at room temperature, both the hysteresis width (\delta T) and the phase transition temperature (T_c) could be tuned: Oxygen increases the T_c and decrease the \delta T, whereas indium decreases the T_c and no change in \delta T. The effect of impurities on this first-order phase transition will be discussed.
