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Atomic-scale Observation of Condensation and Fluctuation of Charge Density Wave in quasi-1D Metal-Insulator Transition SE JUN PARK, JOUNG REAL AHN, HAN-WOONG YEOM, EUN-YOUNG CHOI, WOONJIN JUNG, IN-WHAN LYO, Institute of Physics and Applied Physics, Yonsei University 120-749, Seoul, Rep. of Korea — Metal-insulator transition of two-dimensional In nanowire arrays on Si(111) surface is studied near the transition temperature (T_c). While low energy electron diffraction (LEED) analysis of the system shows a continuous order behavior, however, it is found that both high temperature metallic phase and low temperature insulating phase of charge density waves (CDW) coexist as nanometer-scale domains below T_c . More strikingly, below T_c , nano-scale metallic domains exhibits strong one-dimensional (1D) fluctuation associated with CDW condensates in forms of short, fluctuating 1D segments. Similar events are also found at the domain boundaries between metallic and insulating domains, however, with stronger transverse coupling of CDW fluctuations. These are the first observation of CDW condensation and fluctuation in real-space. In these phenomena, defects appear to play crucial roles in maintaining metallic domains below T_c .

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