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Switching between one and two dimensions: Pb induced chain structures on Si(557) CHRISTOPH TEGENKAMP, ZIAD KALLASY, HERBERT PFNÜR, Institute for Solid State Physics, Universität Hannover, Germmany — The conductivity of epitaxially grown Pb-structures on Si(557) has been measured. Different characteristic transport mechanisms have been found: For coverages above the percolation limit(0.6ML) up to 3ML the electronic transport in the annealed Pb-films is activated. Furthermore, the uniaxial symmetry of the Si(557) surface is reflected directly in a higher conductance in the parallel direction compared to the direction perpendicular to the steps. For coverages higher than 3ML a metallic behavior is found for both directions, i.e. the conductance decreases with increasing temperature. In contrast, already one ML, but annealed to 640K, leads to the formation of atomic wires, as seen by STM, with an extremely high and quasi one-dimensional surface state conductance along the wire direction. At a critical temperature of T_c=78K, the system switches from low to high conductance anisotropy, with a metal-insulator transition in the direction perpendicular to the chain structure, while in the direction along the chains conductance with a (1/T + const.) temperature dependence was found. STM has shown further, that the 1D/2D transition is associated with an order-disorder phase transition of a 10- fold superperiodicity along the Pb chains.

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