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Ordered and isolated CaF_2 nanowires commensurating with Si(5 5 12)-2×1

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The detailed steps of forming one-dimensional (1D) CaF_2 nanowires on the Si(5 5 12)-2×1 surface [composed of one (225) subunit and two (337) subunits] at 600 °C has been disclosed by scanning tunneling microscopy (STM) and synchrotron photoemission spectroscopy (PES). From STM studies it has been found that, initially, CaF_2 molecules adsorb preferentially on one of tetramer rows [i.e., one in T(337)] along the $[1\bar{1}0]$ direction. Then, additionally deposited CaF_2 molecules adsorb on one of dimer-adatom rows [i.e., one in D(337)] and form 1D wires. The density of these 1D nanowires increases as a function of CaF_2 coverage so that, at 0.1 nm of CaF_2, the surface is fully covered with these 1D insulating nanowires. During these procedures, the period of the original Si(5 5 12)- 2×1 is preserved. From the parallel PES study on the Si 2*p* core level it has been found that a Ca-induced species at -0.83 eV and a F-induced species at +0.75 eV at submonolayer coverages, which indicates indirectly that CaF_2 nanowires are commensurating with the Si substrate at the interface. It is clearly proved from the present CaF_2/Si(5 5 12)-2×1 system that the Si(5 5 12)-2×1 surface has the perfect function of template for the growth of isolated and ordered nanowires regardless of existing addimers on the reconstructed surface.