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Kinetically constraint 0-D and 1-D heteroepitaxial islands growth
ZHIPENG LI, MANISH KUMAR SINGH, ENG SOON TOK, JOYCE PEI YING TAN, MIN LIN, YONG-LIM FOO — Direct observation of the dynamics, formation and selective growth of low dimensional epitaxial $Fe_{13}Ge_8$ structures (0-D compact islands or 1-D wires of different aspect ratios) was conducted in *real time* using *in-situ* ultra-high vacuum transmission electron microscopy at 350, 430, 480 and 510°C. Different types of $Fe_{13}Ge_8$ islands (0-D/1-D) and aspect ratio were formed at all the different deposition temperatures. Both types of island share the same epitaxial relation to the underlying Ge substrate. The compact islands are formed preferentially at lower deposition temperature while wires, which are kinetically constrained to grow, at higher temperature. The length/width growth rate was investigated by measuring the island size/shape evolution at different deposition temperatures during growth. The effective E_a for growth along two orthogonal azimuths of an $Fe_{13}Ge_8$ island are 0.17 and 0.95 eV. The temperature dependence in morphology evolution is due to anisotropy in ledge diffusion on orthogonal azimuth during growth. We illustrate that temperature provides an avenue to selectively control the dimensionality (O-D or 1-D) of $Fe_{13}Ge_8$growth on Ge(001) surface.

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