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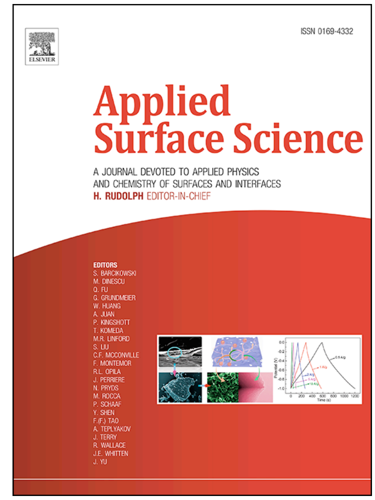

PII: S0169-4332(18)32670-9
DOI: https://doi.org/10.1016/j.apsusc.2018.09.238
Reference: APSUSC 40542

To appear in: *Applied Surface Science*

Received Date: 24 July 2018
Revised Date: 20 September 2018
Accepted Date: 27 September 2018

Please cite this article as: B. Leong Ong, E. Soon Tok, Kinetics During Endotaxial Growth of $CoSi_2$ Nanowires and Islands on Si(001), *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.09.238

Kinetics During Endotaxial Growth of $CoSi_2$ Nanowires and Islands on Si(001)

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Abstract

We propose a phenomenological growth model describing the morphological evolution of two different (ridge and flat) types of endotaxial $CoSi_2$ islands as a function of growth temperature from 500°C to 800°C and for Cobalt coverages from 0.1 monolayer (ML) to 0.5ML. The presence of low energy Type A and Type B $CoSi_2${111}-Si{111} interfaces drives the formation of flat-type islands and ridge-type nanowires respectively. The growth of these nanowires and islands are kinetically constrained, where the islands' length, width and height are experimentally found to follow the Arrhenius relation with activation energies ranging between 0.4 eV and 1.6 eV. Our model suggests that the islands are kinetically constrained by thermally-activated processes such as island-edge diffusion anisotropy and corner energy-barriers, thereby restricting the adatom transfer between long and short sides of the islands. Consequently, at low growth temperatures, ridge-type nanowires are more dot-like while flat-type islands form small wire-like islands. But at high growth temperatures, the ridge islands form long nanowires while the flat islands become more dot-like instead.

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