

Exercise 3.4-1

Quick Questions to

3.4 Structure, Interface and Some Properties

Here are some quick questions:

- What is epitaxial growth? Consider the possibility of epitaxial growth; giving possible conditions (e.g. with respect to structures, lattice constants, ...) and use simple pictures:
 - A on A.
 - A (fcc) on B (fcc).
 - A (fcc) on C (hex).
 - A (fcc) on B (fcc) with intermediate layer.
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- B (fcc; (100)) with lattice constant a_B is deposited on A (fcc; (100)) with $a_B = 0.95 a_A$. Sketch the structure for
 - Thickness of B only a few atomic layers.
 - Thickness of B > 50 nm
- *Difficult!* Sketch a pure edge misfit dislocation network on a {100} interface plane for a misfit of 10 % for the case of
 - Burgers vector of the dislocations is $\underline{b} = a<100>$.
 - Burgers vector of the dislocations is $\underline{b} = a/2<110>$.
- *Difficult!* What would happen if the (square) network of misfit dislocations on a {100} type interface would be changed from edge dislocations to screw dislocations?
- What are the energetic reasons for introducing misfit dislocations into epitaxial interface if the layer thickness is larger than a critical thickness? What determines the critical thickness?
- Sketch the curve for the critical thickness d_{crit} in a d_{crit} - misfit diagram, Try to give approximate numbers.
- Enumerate and discuss *structures* obtainable with thin films but not (easily) with bulk materials. Give examples for applications.
- Give reasons why thin film properties can be quite different from bulk properties; give examples.
- Name some technologically extremely important special thin film properties; discuss with actual numbers.