Critical Thickness for Formation of Interfacial Misfit Dislocations in Epitaxial Semiconductor Systems

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About the Speaker

Anandh Subramaniam did his B.Tech from IIT Madras, followed by a M.E and Ph.D from I.I.Sc., Bangalore. Then he was a scientist in CSIR followed by the position of a Guest Scientist at Max Planck Institute for Metals Research at Stuttgart (as a Max Planck Fellow and as an Alexander von Humboldt Fellow).

After being a faculty in the department of Applied Mechanics at IIT Delhi, he joined IIT Kanpur in the department of Materials Science and Engineering. Selected awards received by him include: The Shri Ram Arora International Award for Materials Science and Engineering Education (TMS, USA) and Young Research Award (IUMRS).

His areas of interest are: Physical Materials Science, Nanomaterials, Quasicrystals, Amorphous Materials, Metastable Materials, Epitaxial Systems, Defects & Interfaces in Materials, Symmetry, Crystal-lography, Transmission Electron Microscopy, Finite Element Method. Using theory, computational theory, computer simulation and experi-ments he has published papers on Metals, Semiconductors and Insulators (Ceramics). He is currently preparing two video courses and also writing two books for undergraduates.

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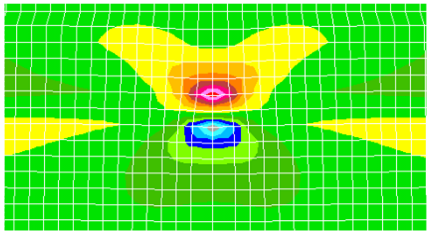
The performance of semiconductor devices based on epitaxial films can be degraded by the presence of dislocations in the system. In Van der Merve growth mode of an epitaxial film on a substrate, misfit dislocations partially relieve coherency stresses on growth beyond a critical thickness. The value of the critical thickness can be determined by global minimization of strain energy or by a force balance approach.

In the case of a finite epitaxial overlayer (stripes or islands), different positions along the interface are not equivalent and the critical thickness will be position dependent. Minimum of these thickness values can be visualized as the global critical thickness. The stress state of a growing epitaxial overlayer is simulated using finite element method and further the numerical model is used to calculate the position dependent critical thickness along the interface. Eigenstrains will be imposed in selected regions in the domain towards this end.

The variation of shear stress along the interface is computed from the model, to understand the issues related to the mechanism of formation of misfit dislocations. GeSi/Si system will be used as a model system for the study.



Dislocation stress-fields in an epitaxial semiconductor film on Silicon.

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