

## Orthogonal Relationship between the Lattice-match and Growth Direction of Planar Nanowires

Babak Nikoobakht<sup>a</sup> and Andy Herzing<sup>b</sup>

<sup>a,b</sup> *Materials Measurement Science Division, National Institutes of Standards and Technology, MD, USA,  
email:babakn@nist.gov.*

The lateral growth has been demonstrated for a number of semiconductors including ZnO on *a*-sapphire,[1] GaAs on GaAs,[2] ZnO on GaN, [3] Mg<sub>2</sub>SiO<sub>4</sub> on Si,[4] GaN on sapphire,[5, 6] and Ge on Ge. [7] , however, because of their good agreement in lattice match and crystal symmetry, the epitaxial relationship between the semiconductor and the underlying substrate has not been well understood. Here we use a highly mismatched system including TiO<sub>2</sub>, a cubic crystal with a 4-fold symmetry on substrates with lower and higher symmetries such as sapphire and GaN to unravel this relationship. In-plane cross-sectional analyses of NWs/substrate show that their lattices, counter intuitively, match along the width of the NWs and not their length. The NW growth axis along the mismatched direction and its symmetry can be explained by formation of a series of anisotropic islands that their long dimension is along the lattice matched direction. Island growth is found to have a preferred growth direction on the substrate orthogonal to the overall growth direction of the NWs.

### References

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