

# EXAFS of Bismuth film grown on Si by MBE

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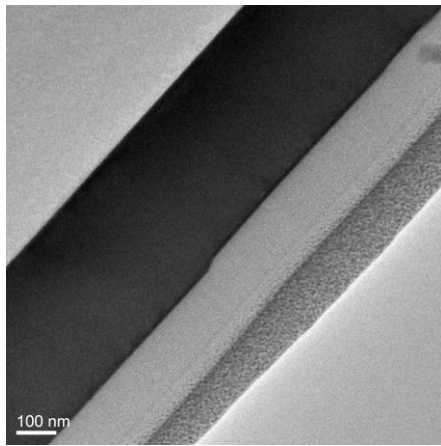
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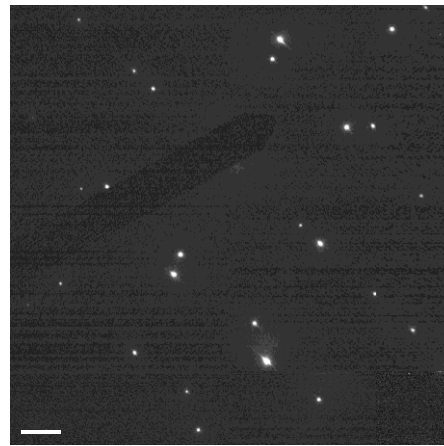
## Abstract

We report on the extended X-ray absorption fine structure (EXAFS) of (0001) bismuth grown on (111) Si substrate by molecular beam epitaxy with the TEM image and TED shown below. Analysis of the EXAFS of Bi L<sub>3</sub>-edge shows that the intralayer first nearest neighbor (1NN) distance is 3.066 Å, very close to the values reported in literature for bulk bismuth [1]. The difference is less than  $6.5 \times 10^{-4}$ , indicating that the Bi covalent bond is nearly free of strain. The fitted Debye-Waller factor is  $1.6 \times 10^{-3} \text{ Å}^2$ , which is smaller than the bulk value [2], suggesting lower structural disorder or thermal fluctuations in the bismuth film. Signal from the interlayer 1NN is not detected. The weak van der Waals bonding of the interlayer could result in a distance broadening which weaken the signal to undetectable level. This work provides evidences for the bonding in Bi crystal thin film which could benefit further Bi related researches.

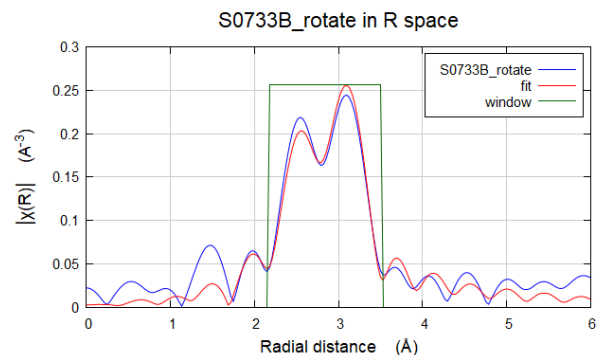
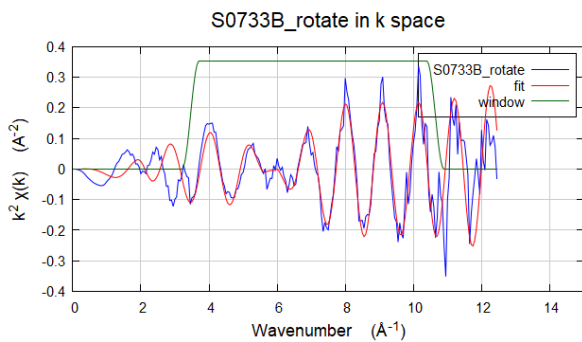
**Keywords - Bismuth, van der Waals epitaxy, integrating with silicon.**



TEM image of bismuth film grown on Si(111) by MBE. The thickness is about 360 nm



Electron Diffraction pattern from the Bi/Si interface. Bi(0003) planes follow along Si(111) planes.



	Intralayer 1NN distance (Å)	coordination number	Debye Waller factor (Å <sup>2</sup> )
Bi thin film (S0733B)	3.066	1.605	0.0016
Bi crystal [2]	3.064	3	0.0031

## Reference

[1] P. Cucka and C. S. Barrett, "The Crystal Structure of Bi and of Solid Solutions of Pb, Sn, Sb and Te in Bi," *Jpn. J. Appl. Phys.* vol. 5, 1966, pp. 865-872.

[2] H. Ikemoto and T. Watanabe, "EXAFS Study of the Local Structure of Bismuth Film Deposited at Liquid Nitrogen Temperature," *e-J. Surf. Sci. Nanotech.* vol. 11, 2013, pp. 110-112.