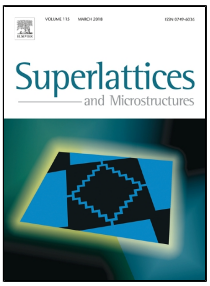
Accepted Manuscript



The localized effect of the Bi level on the valence band in the dilute bismuth $GaBi_xAs_{1-x}$ alloy

Chuan-Zhen Zhao, Min-Min Zhu, Jun Wang, Sha-Sha Wang, Ke-Qing Lu

PII:	S0749-6036(17)33038-0
DOI:	10.1016/j.spmi.2018.03.046
Reference:	YSPMI 5576
To appear in:	*Superlattices and Microstructures*
Received Date:	28 December 2017
Revised Date:	19 March 2018
Accepted Date:	19 March 2018

Please cite this article as: Chuan-Zhen Zhao, Min-Min Zhu, Jun Wang, Sha-Sha Wang, Ke-Qing Lu, The localized effect of the Bi level on the valence band in the dilute bismuth $GaBi_xAs_{1-x}$ alloy, *Superlattices and Microstructures* (2018), doi: 10.1016/j.spmi.2018.03.046

The localized effect of the Bi level on the valence band in the dilute bismuth $GaBi_xAs_{1-x}$ alloy

Chuan-Zhen Zhao [a], Min-Min Zhu, Jun Wang, Sha-Sha Wang, Ke-Qing Lu

(Tianjin Key Laboratory of Optoelectronic Detection Technology and Systems, School of Electronics and Information Engineering, Tianjin Polytechnics University,Tianjin, 300387, China

)

Abstract: The research on the temperature dependence of the band gap energy of the dilute bismuth $GaBi_xAs_{1-x}$ alloy has been done. It is found that its temperature insensitiveness is due to the enhanced localized character of the valence band state and the small decrease of the temperature coefficient for the conduction band minimum (CBM). The enhanced localized character of the valence band state is the main factor. In order to describe the localized effect of the Bi levels on the valence band, the localized energy is introduced into the Varshni's equation. It is found that the effect of the localized Bi level on the valence band becomes strong with increasing Bi content. In addition, it is found that the pressure dependence of the band gap energy of $GaBi_xAs_{1-x}$ does not seem to be influenced by the localized Bi levels. It is due to two factors. One is that the pressure dependence of the band gap energy is mainly determined by the Γ CBM of $GaBi_xAs_{1-x}$. The Γ CBM of $GaBi_xAs_{1-x}$ is not influenced by the localized Bi levels. The other is that the small variation of the pressure coefficient for the Γ valence band maximum (VBM) state of $GaBi_xAs_{1-x}$ can be cancelled by the variation of the pressure coefficient for the Γ CBM state of $GaBi_xAs_{1-x}$.

Key words: $GaBi_xAs_{1-x}$; Bi level; Band gap energy; dilute bismuth

PACS:, 78.20.-e, 78,20.Bh

a) Correspondence email as3262001@aliyun.com