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MBE growth and magnetic properties of GaSb/MnSb superlattices

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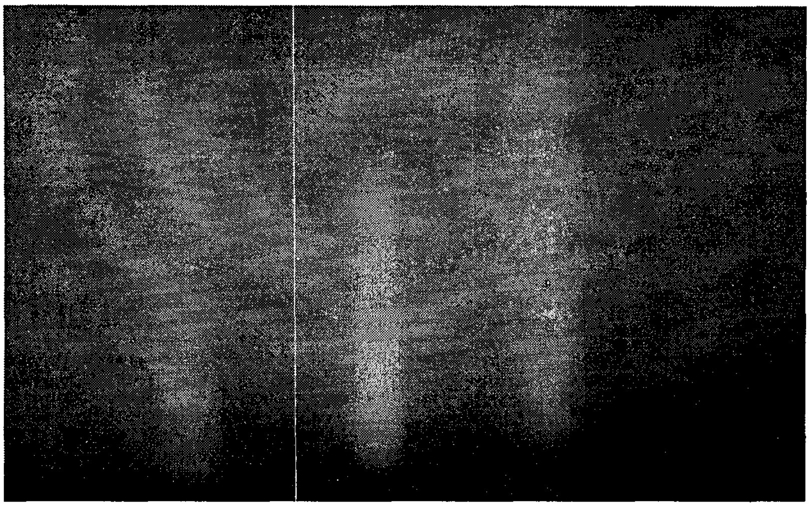
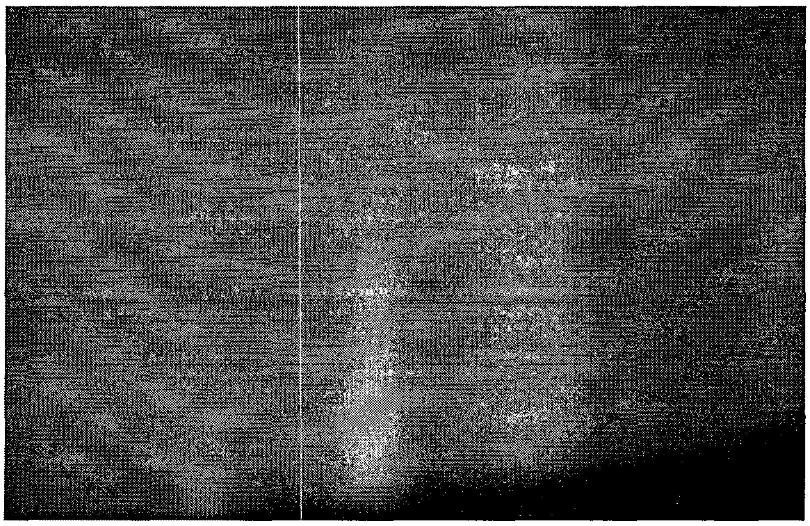
Ferromagnetic semiconductors have attracted great interests because of their potential spintronic device applications. Conventionally, DMS(diluted magnetic semiconductor), which transition metals were substituted into semiconductors such as Ge, Si, Ⅲ-Ⅴ and Ⅱ-Ⅵ semiconductors, have been widely studied as a spin injector and/or spin detector. Here we report a different approach in making ferromagnetic semiconductor by inserting a monolayer ferromagnetic material between semiconducting layers. We have fabricated 55-period GaSb(15Å)/MnSb(2Å) superlattices on GaAs(001) substrates with 1000 Å GaSb buffer layers by solid-source MBE (molecular beam epitaxy). The base pressure of growth chamber was an order of 10^{-10} Torr. The growth temperatures of GaSb buffer layer and GaSb/MnSb superlattices were 450 ℃ and 400 ℃, respectively. The growth rate ratio of Sb/(Ga, Mn) was about 2. We have observed that the streaky RHEED pattern of GaSb or MnSb was maintained even when the growth was finished in 55 periods. Interestingly, GaSb(15Å)/MnSb(2Å) superlattice showed ferromagnetic ordering upto above 400 K with its coercive field of 460 Oe at 300 K. In this talk we will discuss in detail about structural, magnetic and transport properties of GaSb(15Å)/MnSb(2Å) superlattices.



(a)



(b)

Fig 1. (a) **RHEED pattern of GaSb 1000 Å** on GaAs(100) substrate. (b) RHEED pattern of MnSb 1000 Å on GaSb buffer layer.