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Lateral Modulation in Antimonide Superlattices[1]

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Lateral modulation is the spontaneous formation of a periodic modulation in structure or alloy composition perpendicular to the growth direction in an epitaxial structure. It has been observed in many epitaxially grown III-V semiconductor alloys, occurring during both the homogenous growth of III-V alloys and in III-V superlattices. In [001] oriented zinc blende structures, lateral modulation typically occurs along one of the [110] directions and is associated with strain and growth kinetics. It begins when strain is relieved through elastic surface undulations, typically in layers much thinner than the critical thickness for dislocation formation. In a superlattice, these undulations can lead to either compositional or purely structural modulation, depending on the relative phase and amplitude of the undulations in the constituent layers. Compositional modulation is by far the most commonly observed form in superlattice structures. We report on the analysis of purely structural lateral modulation in AlSb/AlAs digital superlattices, using x-ray diffraction. This is the first report of lateral modulation in an antimonide superlattice, and a rare observation of purely structural modulation in a superlattice. InAs/Al(In)Sb digital superlattices were also studied, and exhibited no lateral modulation. The composition and strain of the structures and critical thickness for lateral modulation will be discussed.

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