Self-assembled Sn nanoislands on Ge: From 2D to 3D growth

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In recent years, extensive research has been carried out on the use of Group-IV heterostructures containing Sn for device applications on the Si platform. The 14.7 % lattice mismatch between Ge and α-Sn makes the growth of bulk $Ge_{1-y}Sn_y$ alloys challenging. Here, we focus on the use of molecular beam epitaxy (MBE) for the growth of Sn-rich quantum wells and quantum islands on Ge. The deposition of few monolayers (ML) of pure Sn on a Ge virtual substrate (VS) follows Stranski-Krastanov growth and leads to the formation of self-assembled quantum islands after the initial stages of wetting layer growth. The position-dependent composition of these islands is not only influenced by the deposition itself but also by overgrowth with a Ge cap layer as a result of segregation and diffusion processes. Here, we present recent results [1-3] on island morphologies when growth parameters are varied and discuss challenges in obtaining direct transitions in these low-dimensional structures for possible device applications.

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