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„*In situ* growth studies of SiGe growth on pre-patterned and high-indexed vicinal Si Substrates“

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Si-Ge has been an intensely studied model system for growth of self-assembled quantum dots by the Stranski-Krastanow mode. A prominent feature of these dots is their highly faceted shape [1] that is governed by the formation of energetically favored side facets. The formation of the different dot shapes not only depends on the Ge coverage and growth condition, but also on the substrate orientation [2]. Therefore, the growth on miscut vicinal substrates is of fundamental interest. The (1110) Si substrate orientation is special in this respect due to its particular relationship to the low energy {105} facets of compressively strained Ge because the intersection between these facets is parallel to the (1110) surface. In addition, (1110) facets also play a major role in site-controlled growth of Ge islands on pit-patterned or stripe-patterned Si substrate templates [3,4].

In this presentation, SiGe MBE growth on patterned and vicinal Si substrates was studied systematically using *in situ* scanning tunneling microscopy, allowing sequential growth and imaging of after each growth step [4]. The results on Si (1110) surface shows that the growth properties radically differ from those on the usual (001) Si substrates in that at certain critical coverage of ~ 4 monolayers (ML), a highly stable quasi-periodic 1D ripple structure is formed (see Fig. 1). Below the critical coverage of 4 ML only a random surface roughening takes place, but then an abrupt transformation to a perfectly faceted {105} wetting layer occurs. The ripples completely cover the

whole (1110) substrate surface, in contrast to the usual isolated Ge islands formed by the Stranski-Krastanow growth mode. Thus, the ripples represent a novel pathway for lowering the free energy of the system [5].

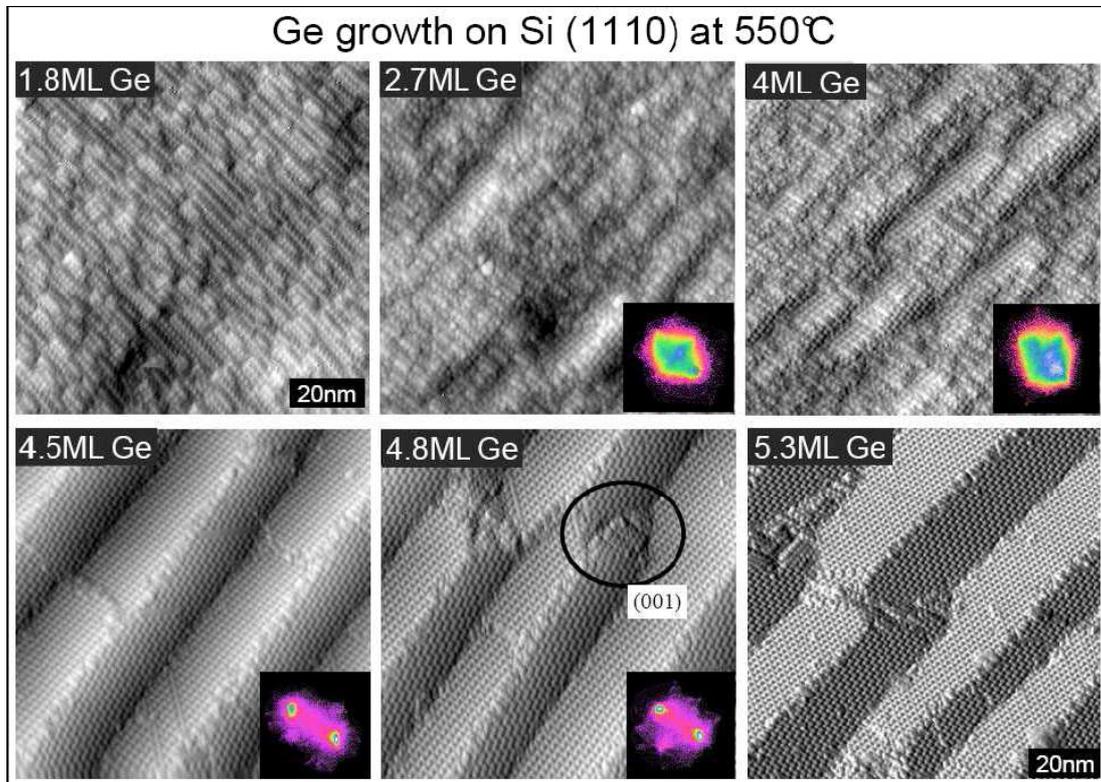


Fig. 1: Scanning tunneling microscopy images of Ge on Si (1110) substrates at increasing Ge coverage from 1.8 to 5.3 ML grown by MBE at 550°C. The surface orientation maps are shown as inserts.

- [1] *see* M. Brehm, et al., Nanoscale Research Letters (in print) and references therein.
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- [3] G. Chen, H. Lichtenberger, G. Bauer, W. Jantsch, F. Schaeffler, Phys. Rev. B **74**, 035302 (2006).
- [4] B. Sanduijav, D.G. Matei, G. Chen, G. Springholz, Phys. Rev. B **80**, 125329 (2009).
- [5] G. Chen, et al., Phys. Rev. Lett., in print.