Self–organized nanostructure formation in the epitaxial growth of Pb/Si(111)

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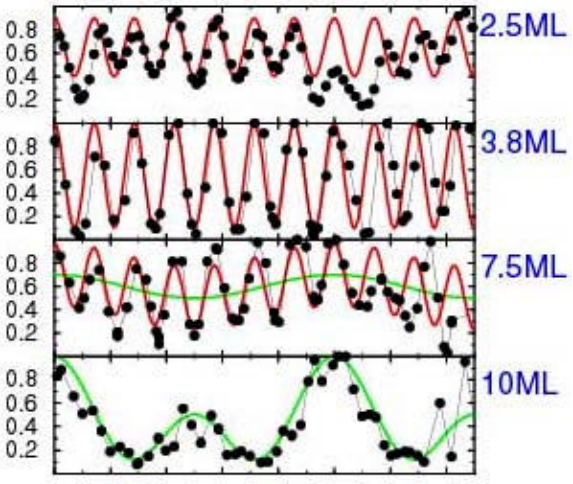

Fig. 1

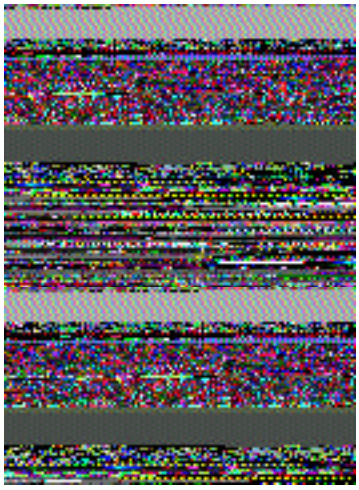

Fig. 2

The ability to grow uniform atomic structures with control of their size and geometry holds promise for many technological applications (i.e.development of ultrafast computers, lasing materials, switches etc.). It is essential that these structures are grown in a robust and reproducible way ,with easy size selection. Recently we have discovered that this is possible in the Pb/Si(111) system if growth is carried out at low temperatures. The evidence is initially based on High Resolution Electron Diffraction (HR-LEED) epitaxial experiments. The technique is analogous to the use of visible light to determine the thickness of thin air films from periodic variations of the intensity (i.e optical fringes). Fig. 1 shows uniform intensity fringes obtained after electron diffraction from epitaxially grown Pb films on Si(111) substrates at T=190K for different Pb coverages[1]. The regularity of the oscillations shows that the islands have uniform heights .Depending on the growth parameters (i.e. coverage, temperature , kinetic pathway etc.) different island heights (5-,7-,9-step) can be selected. This unusal growth mode has been directly confirmed with low temperature STM studies by a group in Academia Sinica Taiwan as shown in fig.2