Ag vicinal surfaces with densely kinked steps

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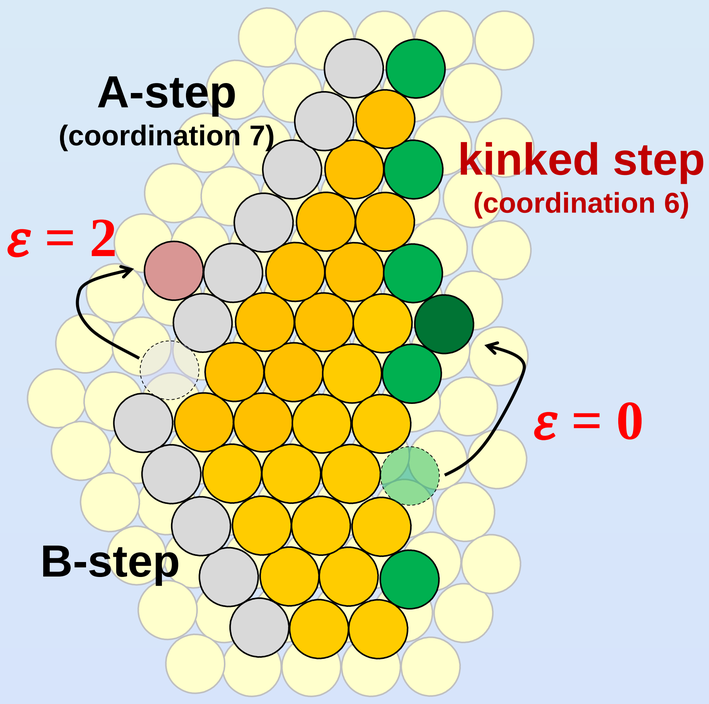
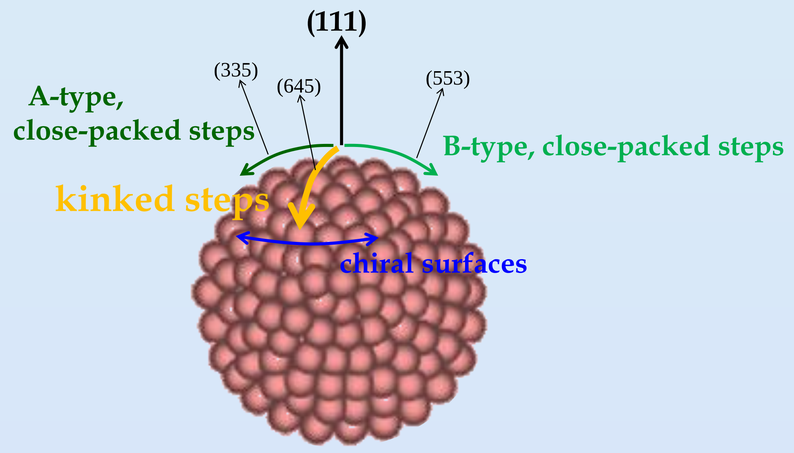
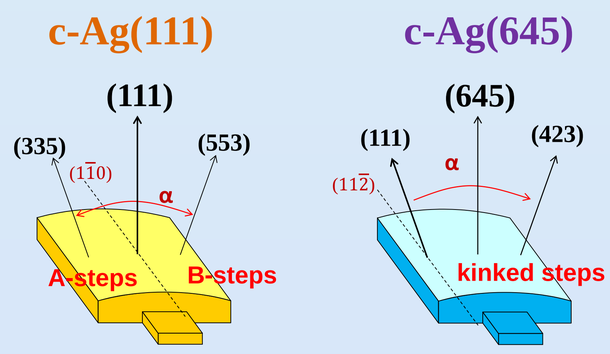


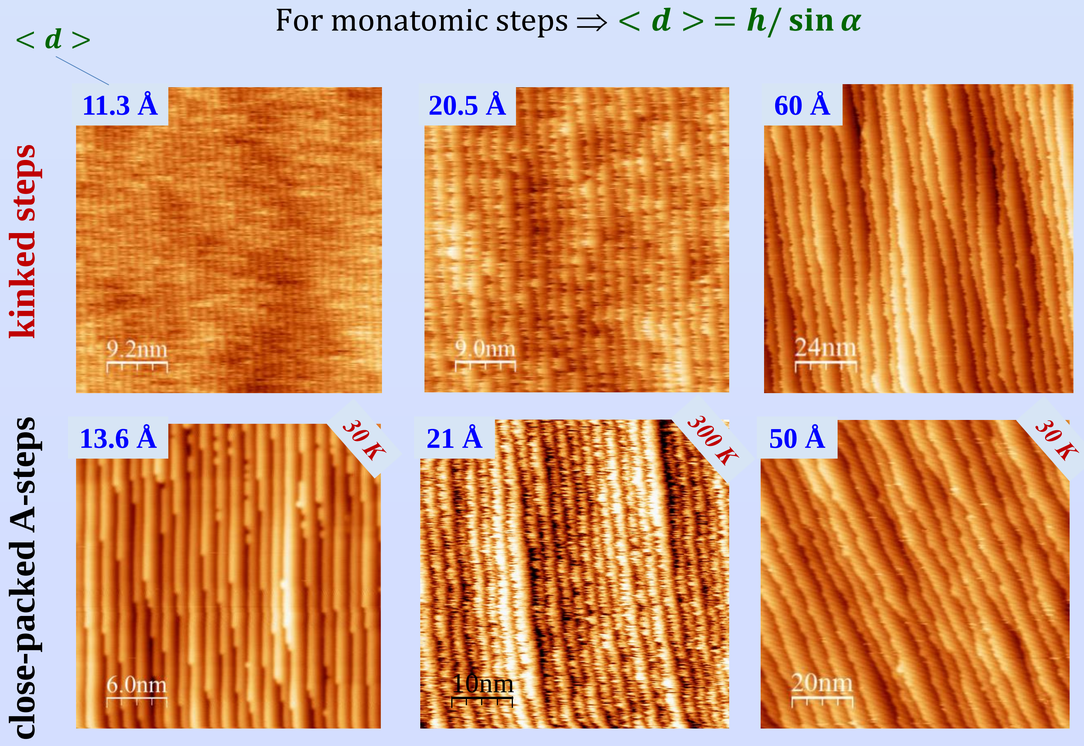


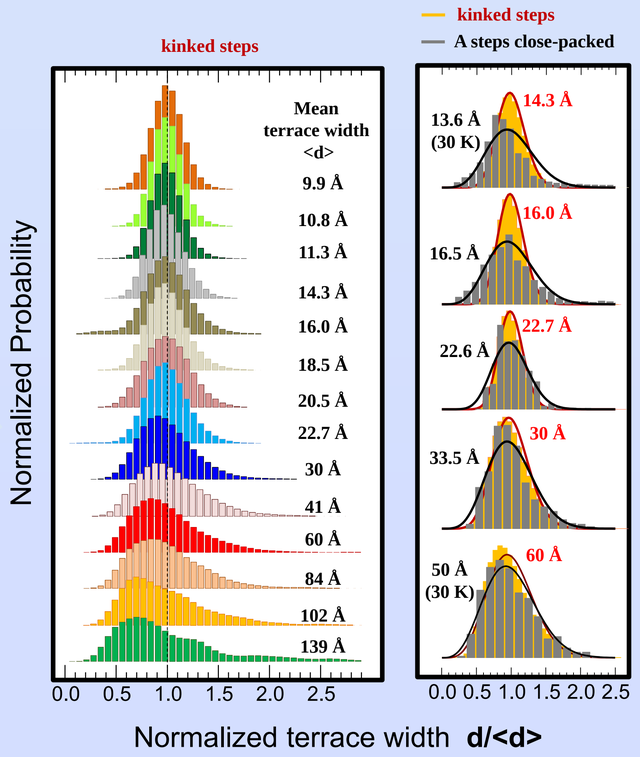


At fcc-(111) vicinal surfaces, steps oriented along the [11$\bar{2}$] direction exhibit "100% kinked" step-edges, where out-protruding atoms have no step-edge nearest-neighbors. Thermal excitations of such lowly-coordinated atoms have zero energy cost ε=0, allowing roughening of step edges without energy penalty. Following the curved crystal approach, **our objective is to investigate equilibrium shape, electronic states, growth and chemistry of kinked vicinal surfaces**.

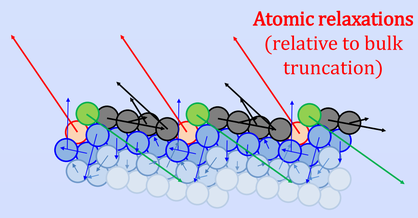
Structure by STM

For monatomic steps ⇒ $< d > = h / \sin \alpha$



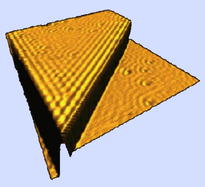


The terrace width distribution (TWD) of a vicinal surface reflects the balance of step-step interactions: entropic, elastic and electronic.

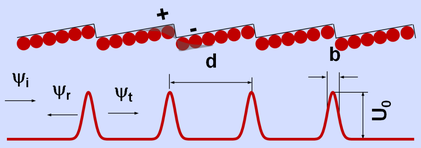


The low coordination (6) of step-edge atoms in kinked surfaces compared to A-B-type vicinals leads to stronger relaxations, and hence to larger contributions of elastic interactions to the equilibrium TWD. This makes the TWD more symmetric (gaussian like, d/<d>~1) and sharper.

Electronic states by ARPES



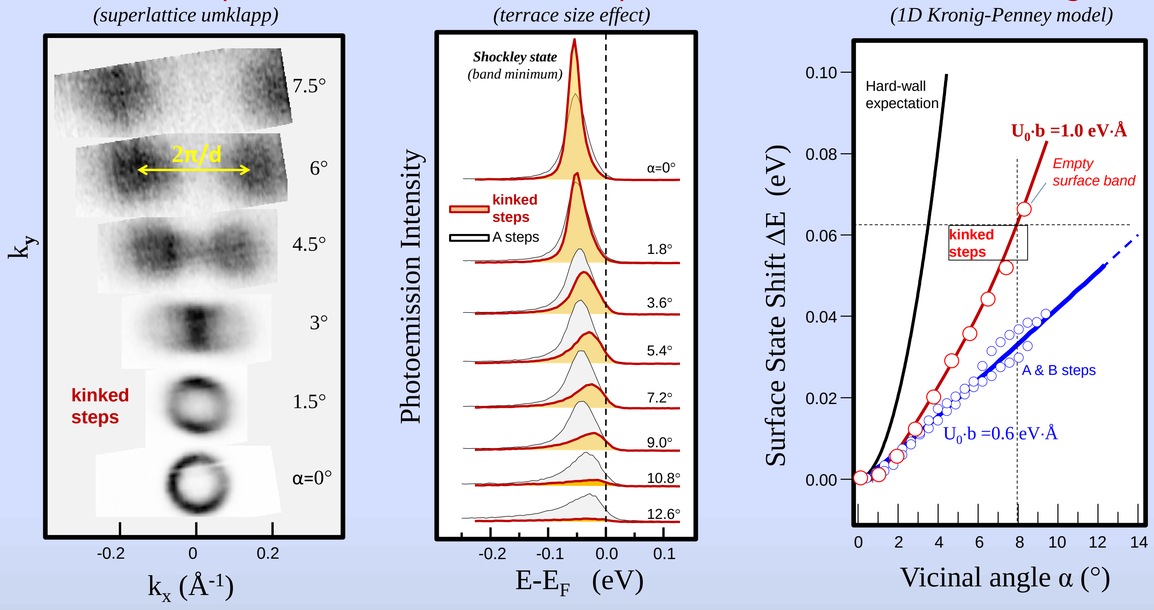
Step superlattice
⇒ 1D Bloch scattering



Fermi surface
(superlattice umklapp)

Band shift
(terrace size effect)

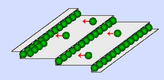
Barrier Strength
(1D Kronig-Penney model)



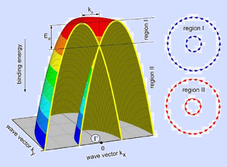
The scattering of Shockley states at steps in vicinal surfaces leads to 1D superlattice effects.

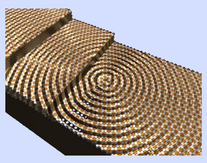
The comparative analysis of terrace-size effects for close-packed and kinked step-edges reveals larger scattering strength in the latter, leading to a complete depletion of electrons in surface bands above a critical 8º vicinal angle.

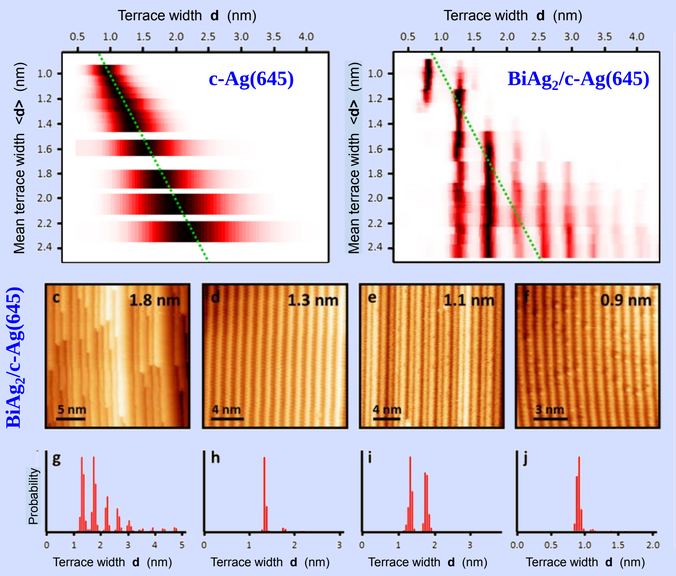
Templated growth: $BiAg_2$



$BiAg_2$
⇒ spin scattering







We test the quality of the kinked vicinal surface as a growth template during the growth of the $BiAg_2$ monolayer alloy. The latter exhibits surface bands with a high spin texturing, thereby becoming excellent model systems to investigate spin-dependent scattering with ARPES.

In the $BiAg_2$-covered kinked surface we observe the clear discretization of the step array in multiples of the $\sqrt{3}\times\sqrt{3}$ atomic lattice constant of the alloy. At two magic terrace sizes (d=1.3 nm and d=0.9 nm) sharply-defined, single domain step arrays are observed.

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