

Two dimensional electron gases at semiconductor surfaces – effects of lattice and surface disorder

Jacek J. Kolodziej, Natalia Olszowska, Jakub Lis

*Faculty of Physics, Astronomy, and Applied Computer Science,
Jagiellonian University, Lojasiewicza 11, 30-348 Krakow, Poland
jj.kolodziej@uj.edu.pl*

Using angle-resolved photoelectron spectroscopy we study the band structures of two dimensional electron gases (2DEGs) formed at surfaces of InAs(001) prepared in various ways. We find that, for surfaces prepared by „peaceful” methods like wet chemical etching, very clear model-like 2DEG bands are obtained. They are also properly explained with the Poisson-Schroedinger scheme. In contrast, for ion bombarded surfaces, nebulous pockets of states instead of discrete 2DEG bands are seen. The pockets have their perimeters corresponding to the band shapes characteristic of InAs(001) based 2DEGs. These observations are explained taking into account the diffusion and chemistry of ion beam induced point defects leading to formation of subsurface potential wells of complex shapes.

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