14. ELECTRON DIFFRACTION AND ELECTRON MICROSCOPY

are therefore not accessible.

Using the channeling technique, both at high and me-
dium energies, the interface rections at the very
first stages of metal depositions on atomically clean Si
surfaces in UHV have been studied for a number of metals,
namely Au, Pd, Ag, Ni and recently also Ti. These stu-
dies have shown, that silicides form, even at room tem-
perature or below, except for Ag, which shows no mixing
with clean Si. Using the high depth resolution of Medium
Energy Ion Scattering, information has been obtained on the
uniformity and morphology of the so formed ultrathinfilms (0-20 Å), showing that transitions from 2D to 3D
film formation are very general phenomena, either direct-
andion deposition (Ag, Ni) or after annealing (Pd, Ti).
The number of Si atoms displaced at the metal-silicon or
silicide-silicon interfaces have been determined for
most of these systems, ranging from 0-2 monolayers.
Epitaxial silicides and their interfaces with Si form
an other interesting group of systems. Ions backscattered
in a crystalline material are blocked on their way out
by atomic strings or single (surface) atoms, giving rise
to so-called blocking minima in the backscattered yield
for such directions. With the aid of an analyser with
high angular resolution metal- and semiconductor surface
structures have been determined, as well as silicide
phases, metal or silicide orientations and pseudomorphic
growth of epitaxial silicides. Finally, in the case of
good epitaxy, as for instance for the lattice matched Ni51Si system, the ion beam can be aligned with a sili-
cide-channel, such that only the surface and interfa-
cy layers are hit by the ion beam. These studies have shown, that the interface is highly ordered, showing less than
*3 x 10^16 Ni atoms/cm² to be displaced from lattice posi-
tions.

In conclusion, with the development of UHV ion back-
scattering facilities, and the use of high resolution
detectors, it is now possible to study the structure of
interfaces and other 3D structures.

14.1-1 COMPUTER SIMULATION OF CONVERGENT BEAM ELECTRON DIFFRACTION PATTERNS. By H.S. Blom
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Convergent beam electron diffraction (CBED) is a well
known technique for determining the space group symmetry
of single crystals (Buxton et al., Ph. Tr. R. Soc. London
(1976) 281A, 171) and, more recently, of bicrystals
(Schapink et al., Acta Cryst. (1983) A39, 805; Buxton
et al., Inst. Phys. Conf. Ser. No. 68 (1979) Ch. 2). In both
cases the CBED patterns are classified according to 31
diffraction groups, which in turn can be related to the
32 point groups in the single crystal case and to 58 chro-
nematic point groups in the bicrystal case. In the bicrystal
classification, the assignment is being made of having the
grain boundary plane coinciding with the mid-
plane of the bicrystal, parallel to its surface plane.
This paper is concerned with the effect of the boundary
location on CBED pattern symmetry, employing computer
simulation based upon the n-plane dynamical theory
(Nethe, Ann. Physik (Leipzig) (1928) 87, 5). Results
are presented for a silicon bicrystal with a <111> twin
boundary showing a 6 mm bright field (BF) symmetry and
a 3 mm overall symmetry (WP). Further it is confirmed
that a particular translation along the boundary results
in a decrease in symmetry of both BF and WP, in agree-
ment with previous expectations (Schipink et al.,

14.1-3 CBED PATTERN SYMMETRY ASSOCIATED WITH THE SYMMETRY INCLUDING THE TRANSLATION COMPONENT NORMAL TO THE SURFACE. By K. Ishizuka, Institute for Chemical
Research, Kyoto University, Uji, 611, Japan

The symmetry of convergent-beam electron diffraction
(CBED) patterns was investigated by Goodman (Acta Cryst.
(1975) A31, 804) and Buxton, Eades, Steeds and Rackham
extinction bands in CBED associated with the translation
parallel to the surface was studied by Gjønnes and
Moodie (Acta Cryst. (1985) A41, 65). However, there was
a distinct discrepancy concerning the CBED symmetry asso-
ciated with the symmetry operation which has a transla-
tion component normal to the surface: Goodman predicted
no associated symmetries, while Buxton et al. assumed no
detectable effects of the translation. Moreover, the
extension band associated with the translation normal
to the surface was also observed (e.g. Steeds, Rackham

The present author showed that an approximate symmetry
and extinction bands are expected for the symmetry ope-
rating including the translation component normal to the
surface, and the detection of the deviation might be
difficult (60th Ann. Proc. EMSA (1983) 684). In this
report, the dynamical calculations based on the multi-
slice method has been carried out to verify the previous
arguments. The calculations show that the extinction
associated with the d-glade planes in the natural spinel
(NaAl2O4) is almost complete: the intensity at the
extinction band is always less than 1x10^-3 of an unit
intensity, while the intensity of bright lines appeared
in a 200 disk is increased with the specimen thickness
and becomes more than 1x10^-3 even at the thickness of
450 Å. The deviation from a mirror symmetry expected
for the d-glade planes is negligibly small.