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CORRELATION BETWEEN SHORT AND LONG RANGE ORDERING IN CRYSTAL GROWTH?

G. Andersson
Uppsala University Department of Physics Box 530 UPPSALA 75121 SWEDEN

The dependence of the interface quality on growth temperature in ^{57}Fe/V (001) single crystal multilayers; has been investigated using x-ray diffraction (XRD) and conversion electron Mossbauer spectroscopy (CEMS). Samples with 20 repetitions of a double layer with 7 monolayers (ML) of isotope-enriched iron and 5 ML of vanadium were grown by magnetron sputtering onto MgO (001) substrates at temperatures in the range 230-330° C; since this has been shown to be suitable [1]. The higher point 430° C was included to see the effects of a considerably raised temperature. XRD at low and high angles yields averaged information on the long-range order throughout the samples. The results indicate that the sharpest interfaces between Fe and V are obtained at 300-330° C; as previously observed [1]. At lower temperatures the chemical modulation is still distinct; but the crystal quality decreases; making the interfaces rougher. At the highest temperature the crystal quality increases; but the interfaces are probably smeared due to extensive alloy formation. A low degree of chemical modulation is still observed. The CEMS results; showing on the contrary the local environments of the ^{57}Fe nuclei; yield a slightly different picture. Here; the variations between the samples grown at temperatures up to 330° C are very small; suggesting that the short-range order is similar in all these samples. The film grown at 430° C is still significantly different; with clear signs of alloying through the entire Fe layers. Additional magneto-optical measurements showed the expected ferromagnetic behavior.

References
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Keywords: EPITAXIAL GROWTH MULTILAYERS MAGNETISM

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ANGLE-RESOLVED PHOTOEMISSION FROM STRONGLY CORRELATED SYSTEMS

M. Asensio
LURE, Centre Universitaire Paris Sud, Bat 209D . 91898 Orsay, France. and Instituto de Ciencia de Materiales, CSIC, 28049 Madrid, Spain.

Angle-resolved photoemission (ARPES) has been a useful tool to study single particle properties of high-T_c superconducting materials. Recently, two main approaches have been used to measure the Fermi surfaces of these strongly correlated compounds. The traditional one based on the measurement of energy distribution curves in order to determine the Fermi level crossing of the quasi-particle bands and a second approach which is based on measuring the photointensity within a narrow energy window at the Fermi level to get the distribution of spectral weight near the Fermi level in large portions of the k space. This second approach provides a global view of the topology of the Fermi surface throughout the whole BZ. However, the photointensity images are influenced by strong matrix elements. In this communication, we report on recent photoemission data of the normal state of Bi2212 compounds (T_c = 91 K). As a function of the incident photon energy, we have performed complete scans of the BZ in two different polarization geometry detections. Particular attention has been paid to the current controversy on whether or not the Fermi surface is electron or hole-like. The completeness of our results provides a clear identification of the key features associated to the Bi-based high T_c superconductors.

Keywords: SUPERCONDUCTOR 'FERMI SURFACE' PHOTOEMISSION

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FERMIOLOGY VIA HIGH RESOLUTION COMPTON

N. Shiotani
Photo Factory, Institute of Materials Structure Science Oho 1-1 TSUKUBA, IBARAKI 305-0801 JAPAN

In the last ten years or so Compton scattering has been firmly established as a tool to study the nature of electron system in metals and alloys. The method is particularly suited to studies of Fermiology of disordered alloys because the method does not require a long mean free path of electrons. The information experimentally obtained is a projection of three-dimensional electron momentum density on to the photon scattering vector. This fact is a drawback of this method. However, when Compton profiles are measured along judiciously chosen directions, it is possible to reconstruct the three-dimensional momentum density via various mathematical procedures. Then, having recourse to the so-called LCW-folding, we can map out a three-dimensional Fermi surface. The geometry of the Fermi surface of a Cu-Pd disordered alloy and a Cu-Al disordered alloy are discussed in connection to the mechanism of the short range ordering in their disordered phase. The electronic structure of some oxides are also discussed.

Keywords: COMPTON SCATTERING FERMIOLOGY ALLOYS

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INELASTIC X-RAY SCATTERING OF MAGNETIC MATERIALS

P. A. Montano
U. S. Department of Energy Materials Sciences and Engineering Department 19901 Germantown RD GERMANTOWN MARYLAND 20874 USA

Non resonant IXS provides information on the dynamical structure factor S (q,w), if the incoming photon is circularly polarized one can obtain in principle information about S (q,w*f*zs). In reality, this type of experiment is still very difficult in the low momentum transfer regime. In the high momentum transfer regime Compton scattering is a well-known type of IXS that is used to determine electron momentum distributions. One can obtain from Magnetic Compton Scattering (MCS) the magnetic spin distributions by using circularly polarized photons. We have used MCS to measure the spin distribution in various ferromagnetic systems. We performed MCS measurements as function of temperature and crystal direction, samples were mounted in a superconductor magnet. We made use of the elliptical multipole wiggler at the APS, this device has electromagnets to switch the horizontal magnetic field. We measured the Magnetic Compton profiles (MCP) in $La_{1.2}Sr_{1.8}Mn_2O_7$. The MCPs were compared with electronic structure computations performed using a semi-relativistically approach within the all-electron fully charge and spin self-consistent KKR framework. Excellent agreement between theory and experiment was observed. MCS was also used to study the magnetic spin distributions in NiCu alloys; we measured the profiles as function of Cu concentration. The MCPs in this itinerant ferromagnetic system were compared with the theoretical calculations of Bansil et al, good agreement between theory and experiment was observed.

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