Comparison of the Wehner Spots With Angle Distribution Sputtered Atoms Materials

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Abstract: The causes for the Anisotropy in the angle distribution sputtered atoms is yet extensively unexplained. Therefore experimental investigation should be carried out to this question. The ions beam was used for comparing investigation between the distributions of back steered ions and sprayed atoms. We know that the pulverization of crystals shows an anisotropic angular distribution of pulverized atoms. The appearance of these phenomena is initiated once Wehner spots are obtained by putting a receptor in front of the sample, which shows a correlation with the principal crystallographic axes. Other study shows that till now the studies and works already done are not strongly founded in the sense of the correspondence of the Wehner spots and the principal axes of the crystals. Measurements are represented in many works and during the last years detailed studies on gold crystals (111). Principally the gold atoms emissions have appeared in the directions (110) and (111) for which the intensity to energy ratio of projectile ions is modified. Emissions directions are to be maintained in addition to representation and for omitted raison directions changes have to be taken into account. After the studies of deviations in the emission direction appear during the copper crystals pulverization. The authors allocate this fact to the influence of the forces of superficial links which should generally lead to a preference of the particles emission in the normal direction to the surface. The question is who it makes that the link ratio for different crystals directions have a different response; however, it is shown that the application of an ionic beam emitter, to examine the interference of the direction emissions of the pulverized atoms with principal crystallographic axes is necessary. [Researcher. 2009;1(1):41-45]. (ISSN: 1553-9865).

Key words: Anisotropy, angular distribution, sputtering, crystallography

Experimental and Methods

The principle of the exact determination of the angle distribution sputtered atoms and the crystal direction was based up on the registration of the particle currents in the pulverisation through precipitation development on a transparent plastic foil and through photographic registration of the particle current reflected Proton arrangement shows in Fig.1. In a reason disk out of aluminium, a hole is bored in the middle to the reception of the copper-mono-crystals. Around the crystal as an axis, a cylindrical screen is mounted, that is connected with the circular disk firmly. This screen contains in the middle a hole through which the ions ray is arranged on the sample. The screen consists of a film stage, in which a transparent plastic film could be inserted to measure the angle distribution of sputtered atoms or a photographic film, with which an over energy, reflected Proton become (Protonogram) recorded.

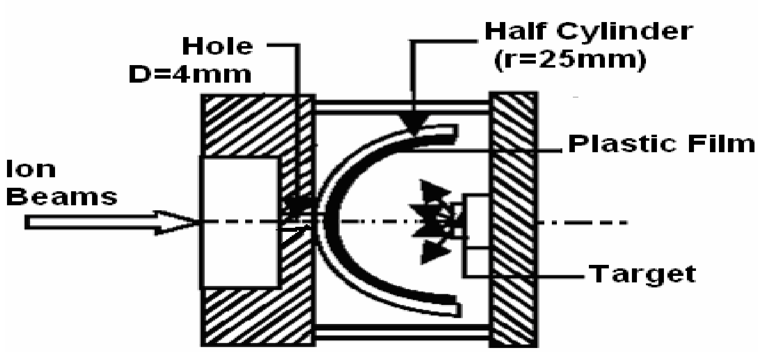

Fig. 1 : Schematic representation of radiation

Because in the two cases the disposal (arrangement) of the film support is the same with respect to the crystal, we can superpose the film and the transparent to observe that the correspondence of the emitted particles and the crystallographic axes of the sample.

Wehner Spots Apparition

To determine the angular distribution of the pulverised atoms, a transparent sheet is inserted in film carrier linked to the device in which is placed the sample (copper mono-crystal) with the wanted direction, the device being connected to the last electrode placed under the ions optics land of the beams emitter.

With a current of about 100µA, the sample is bombarded with Ne and Ar ions during 15-30 min., as a result we obtain the matter distribution on a plastic sheet and because it consists of a cylindrical arrangement, it is important to place the emission direction in the meridian plane of the device, in addition the crystal should be turned in parts around its axes until the geometry is optimal to measuring angle, this has been reached after 2-3 tests. With this arrangement and the desired image we undertake the copper crystal direction in the film carrier and this is done due to the angular distribution recording of the reflected protons.

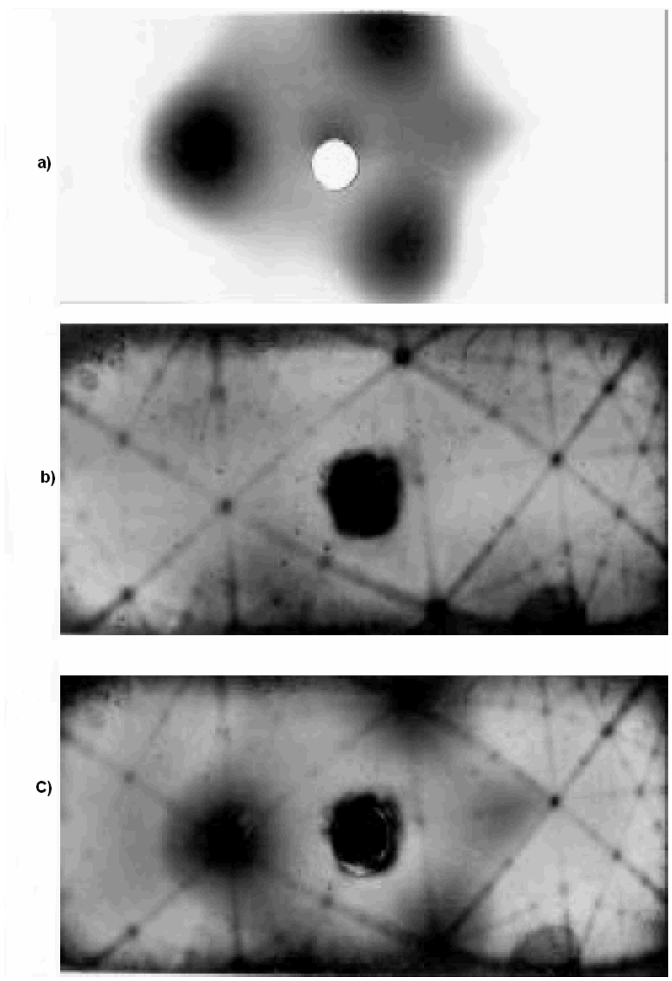

Fig. 2**:** Comparative representation of the network plane structure of a mono-crystal Cu-(111) obtained by measurements of dispersion with protons (protonogram). With the arrangement of Wehner spots, during the same angle of deviation between the surface and the axis of the crystal, a)Wehner Spots by Protonogram c) Common copy of the two photography that shows clearly the Wehner spots deviation very weak compared to the desired emission direction according to the protonogram

Determination of the Crystal Direction

We bombard the copper mono-crystal with weight and rapid particles; hence those penetrate deeply in the crystal. For protonogram photography we have taken 300kV protons with a 2μA current, an exposure time of 10s and a desensitized film, the desensitizing of the film necessitate the device installation in the dispersion room under the green light.

The protonogram is based on the reflection of the weight projectiles on the heavy atoms sample, the weight and rapid protons deeply penetrate in the mono-crystal. During a redispersion of the protons in the total angle sector around atoms network can be lighted up, a proton can be also reflected due to a collision with the atoms network in all the direction of observation, here however every atoms network is surrounded with adjacent atoms, regularly distributed and this for every adequate atom is repeated in the depth direction and the side. The protons can not be emitted by the effect protecting the adjacent atoms along their distribution direction. Even though, the protons are reflected in all the direction during the particular spreading process on the atoms network, they are however, stopped by the surrounding adjacent atoms in this direction of emission.

Because in this direction no proton is emitted, given rise on the gleam screen or on photographic film as an plane image of the network with darken films on the illuminated background plane which is produced by irregular spread protons. Because of the effect protecting adjacent atoms we call the process “Blocking Effect” or the “Shadow Effect” (Barett, 1973).

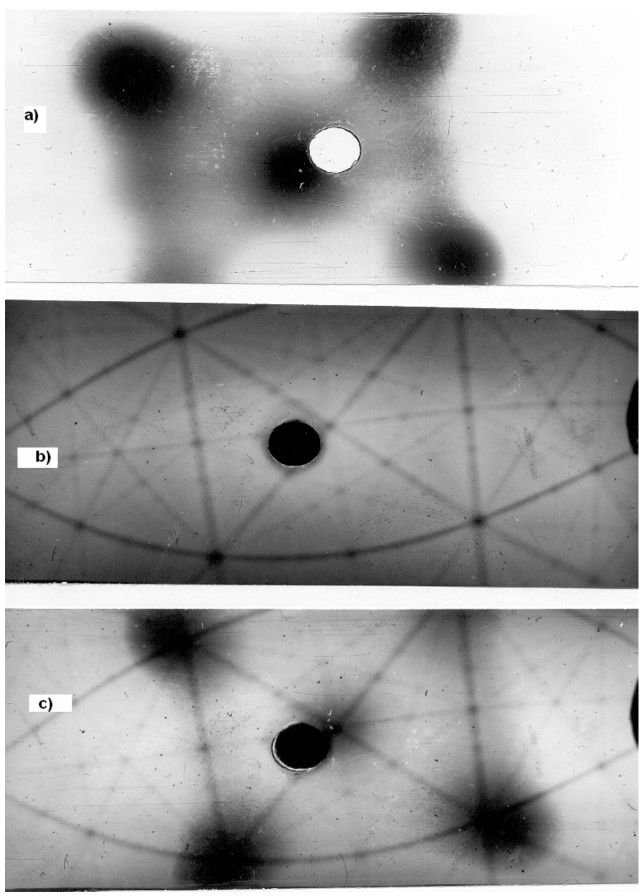

Fig. 3: Comparative representation of the network plane structure of a mono crystal Cu-(001) obtained by the dispersion measurement using protons (protonogram). With the Wehner spots arrangement, during the same angle deviation between the surface and the axis of the crystal.

a) Wehner spots.
b) Protonogram .
c) Common copy of the two photographies: Wehner spots and mono-crystal principal axis directions that correspond
well surface normals.

Discussion and Summary

As it is shown in the Fig. 3 that with direction crystals of surface (100), the emission direction and the crystallographic axes are well joined. On the other hand**,** for crystals (111) (Fig. 2) the directions correspondence with pulverisation images exist; while for the directions (100) a deviation is clearly observed with respect to (100) direction in the protonogram of around 2 mm with a radius of 25 mm of the film carrier of cylindrical form corresponds to a 20° of angle shifting. The emission direction of the normal is preferred. Similar observation are already done by the work (Niedrig et *al.,* 1987), if the cause should be the engagement energy of the surface, this should also affect the directions (100), because they passes also to the surface normal. For the other directions of the crystal also, we could observe the shifts. According to work (Robinson, 1981), overcoming the voltage barrier at the surface should cause angle enlargement at the output during the extraction of atoms relatively the normal, however the opposite shift is observed for centred crystals clear deviations of the position of Wehner spots is also observed. Consequently, it is evident to postulate to surface atoms relaxation,, this should be easily seen, because the atoms of the centred side position possess the shortest path of link compared to the atoms at the cubic corner points of the crystal network with centred fronts. If a crystal of this type is cut along the surface diagonals, these atoms arrive to the surface because they are under pressure due to their short link distances, they can be relaxed; this relaxation should be recovered on the first and the second atoms positions. Is it about the surfaces (100) or (110), the relaxations in the pulverisation image are not shifted, because the percussion direction coincide with the relaxation direction. If it is about however, more surface (111) , the relaxation direction and the percussion direction between the atoms of the first and the second position do not correspond anymore.

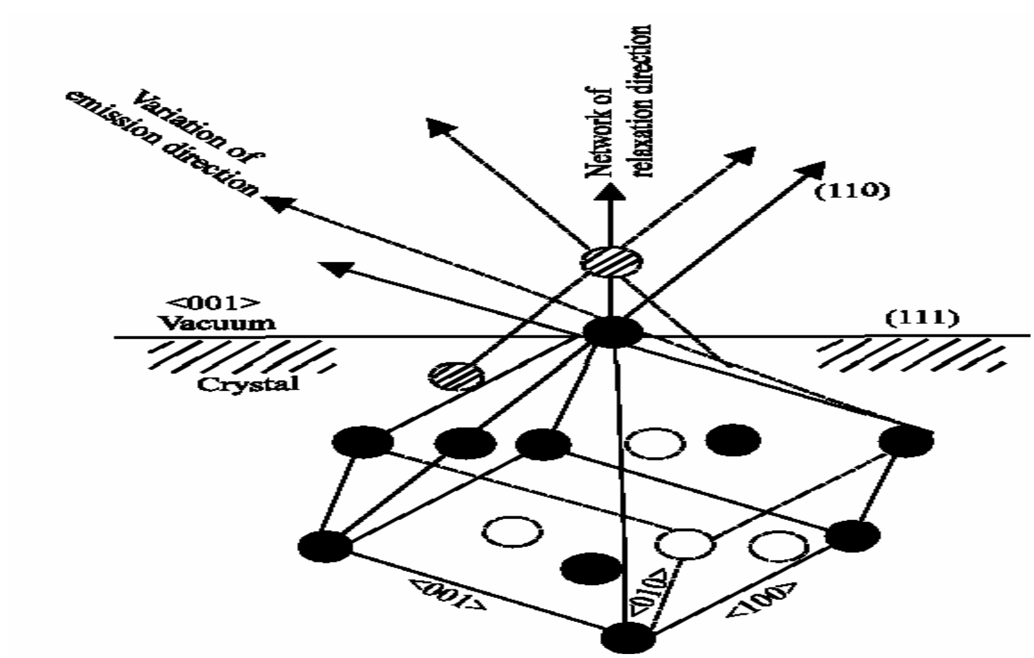

Fig. 4: Schematic representation of the process, For the relaxation of atoms vertical with respect to the surface emerges a modification in the Wehner spots situation. While for the spot (100) stills not influenced by the relaxation, It is produced for the axe (001) a change in the particles emission direction

If we evaluate quantitatively the shift on the basis of the model shown in Fig. 4. A relaxation of atoms on the surface, 50% of this value is calculated by the adoption of the appearance or creation of Wehner spots comes from the percussion interaction between the adjacent atoms is always a central percussion, i.e.: There exist no preferred percussion direction of second position atoms, however the atoms possess percussion energy of second position atoms in the preferred direction, which coincide with the packed and close balls directions. Hence, the oblique percussion between adjacent atoms are also possible. In this case, the network atoms are not concerned, but the percussion radius which is crucial and the ratio between the distance and the percussion radius of atoms which decide on the percussion oblique if it increases or decreases. With percussion radii which are small with respect to network gap, the oblique deviation increases concerning the central percussion, because the transferred energy of the surface atoms during the pulverisation increase in a multiple of links energy, the percussion radius can be ten times less than network distances, hence the network relaxation values are reduced from 50 to 5%. Similar values have been found (Davies et al., 1975; Saris, 1982) with the measurement of Surface-Blocking-Effect, h s method is relatively expensive and necessitate very high vacuum conditions, the arrangement of the Wehner spots relaxation process is in the other hand simpler and possible under the high vacuum conditions, if we increase also the sensitivity of the measurement method with the use of a particle test, it can be possible not only to determine the metals structure, but also the arrangement arbitrary matters atoms on the surface, if it is sufficiently regular. Consequently, it appears very important also to examine very far the mono-crystals surface particles emission question and other matters, because new structural analysis methods of solid bodies' surfaces can emerge.

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