Fifth International Conference on Cold Fusion
9-13 April, 1995 - Monte Carlo, Monaco
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INFLUENCE OF PERFECTION OF SODIUM TUNGSTEN BRONZE SINGLE CRYSTALS ON NEUTRON EMISSION

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Abstract

Correlation between crystal structure perfection and neutron emission has been found. Positive result on neutron generation has been established only for crystals with "specific" X-ray diffraction pattern. This allows to treat X-ray data as a selection criterion. The crystals has proven to be rather perfect. Damage of perfection of the surface layer results in absence of the effect .

1. Introduction

Tentative selection of single crystals as catode material[1] seems to be the most optimal way to reproduce positive results on cold fusion. Up to now no experiments have been performed to find fitness criterion of crystals.

Thanks to X-ray analysis of a crystal structure before and after cold fusion experiments such criterion has been found for sodium tungsten bronzes.

2. Results and discussion

X-ray measurements were done on a diffractometer DRON-3 at U= 20 kV, I = 10mA and Cu k_α radiation.

X-ray diffraction patterns of the crystals without the surface admixtures (e.g. polytungstates, tungsten etc.) were chosen for analysis. However, it does not mean that there were no admixtures inside single crystals. Since the {100} plane was exposed to X-rays, the patterns show four maxima corresponding to the (100), (200), (300) and (400) reflections of different orders.

Intensities of the above diffraction maxima are seen to be high (Fig.1) for the crystals with a positive result (i.e., neutron counters registered signals on the level not less than 4σ). Alternatively, for crystals without a positive result peak intensities of the third and forth order (sometimes even of the second one) are essentially lower ($I/I_0 < 50$) (Fig.2). Similar X-ray patterns are observed for crystals which loose their ability to generate neutrons during experiments (Fig.3).

Such variation in the intensity of the diffraction peaks may, seemingly, be attributed to the second extinction. In this case with X-ray penetration intensity weakens in different mosaic blocks, resulting in damage of strict phase relations by dislocations, point defects and subgrain boundaries.

Increasing number of microblocks as well as structural imperfections occurring during tranformation from a "fitting" to "unfitting" crystal is supported by the X-ray topograms. Surface topograms for "fitting" and "unfitting" crystals are shown, respectively, in Figs. 4 and 5. It is also found that a transformation from "fitting" to "unfitting" crystal is accompanied by change for the worse in the surface layer perfection, the reflection being smeared (Fig.6).

This allows to conclude that one condition to attempt a positive result is a structure perfection of the working plane of sodium tungsten bronze. Damage of perfection of the surface layers results in absence of the effect.

Probably, neutron emission can take place during the change from perfect to mosaic crystal, which, to a certain extent, supports the "accelerated" model of cold fusion[2].

Tentative evaluation of the crystal quality allows to give some recommendations concerning crystal growth. For instance, it is of no sense to keep on growing crystal from a "unfitting" seed since it will not be perfect enough (Fig.7) as shown by our experiments.

To obtain a crystal with positive effect we recommend to grow it under optimal conditions from the first moment of nucleation. Attempts undertaken to prepare the working plane by polishing and etching have failed (Fig.8).

Acknowledgments

The research was supported by Russian Fundamental Research Fund.

References

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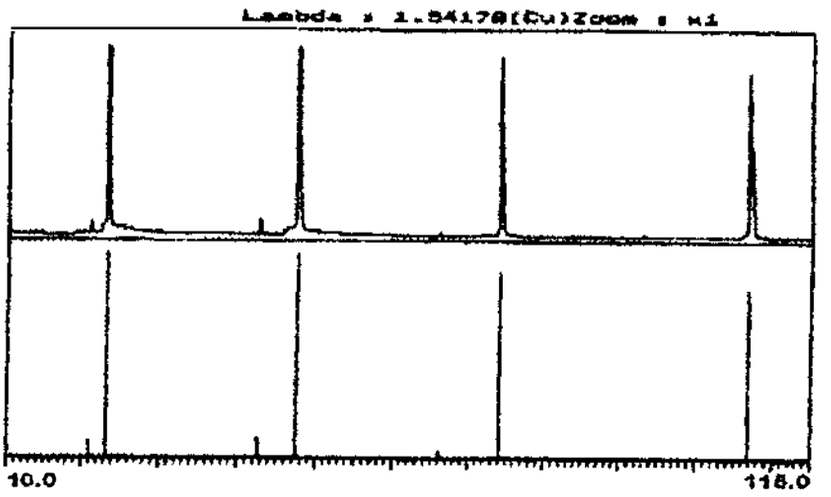
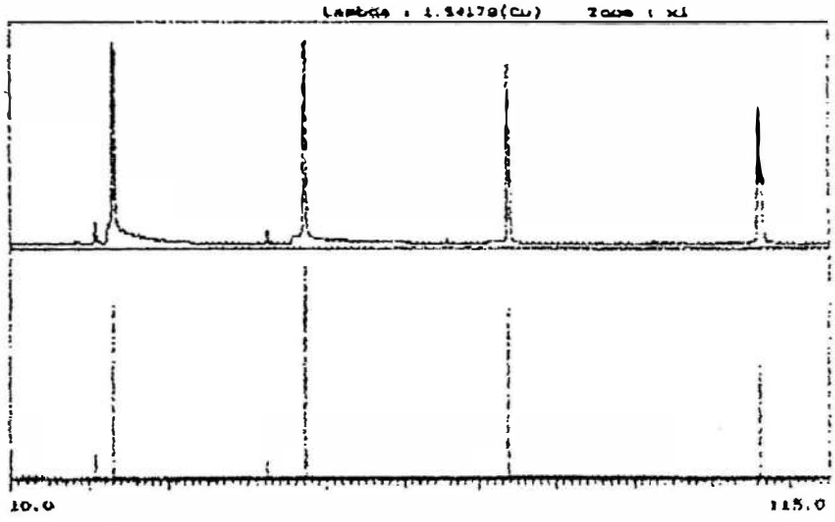
2. V.Tsarev, "Cold Fusion," *Uspekhi Fizicheskih Nauk*, **160**, 1 (1990).

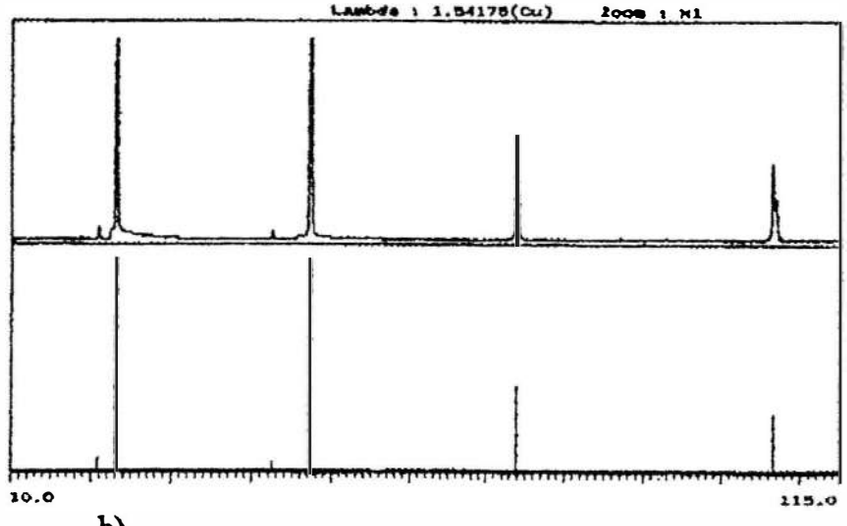


Fi g. 1. Typical X-ray diffraction pattern for the {100} plane of a cubic sodium tungsten bronze single crystal before experiment. Positive result on neutron emissio experiment at the level of 4σ.

Fig. 2. Typical X-ray diffraction pattern for the {100} plane of a cubic sodium tungsten bronze single crystal before experiment. No positive result.



a)



b)

Fig.3. X-ray diffraction patterns for the same {100} plane of a cubic single crystal before (a) and after (b) experiment. During experiment the crystal stopped showing neutron emission.

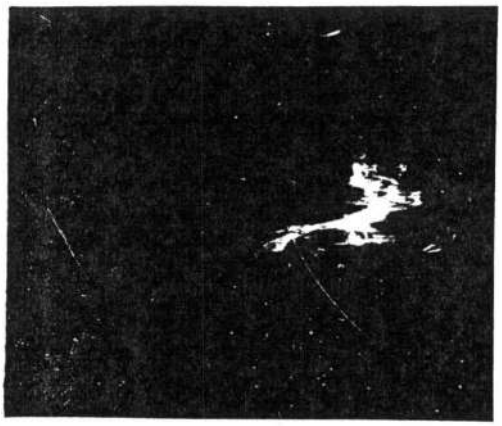


Fig.4. Typical topogram for the {100} plane of a cubic sodium tungsten bronze single crystal before experiment. Positive result at 4σ.

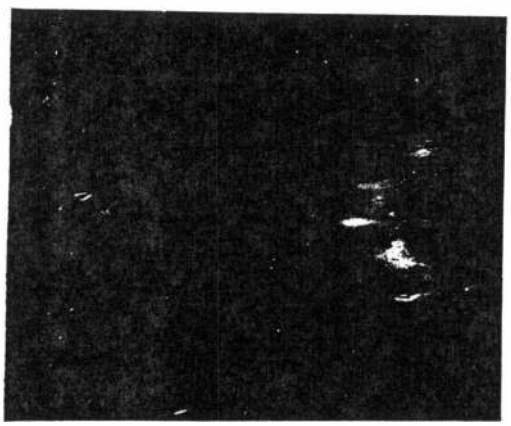
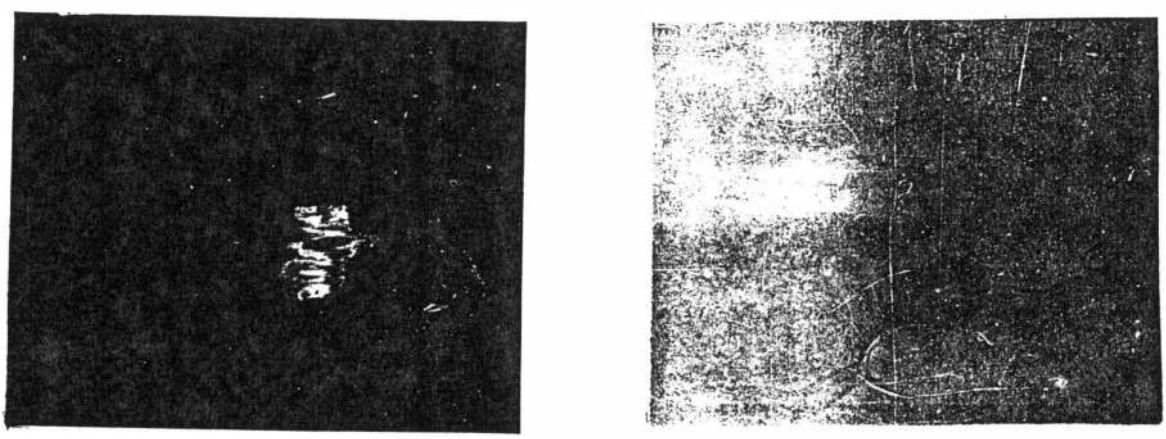


Fig.5. Typical topogram for the {100} plane of a cubic sodium tungsten bronze single crystal before experiment. No positive result.



a b

Fig.6. Topograms for the same {100} plane of a single crystal before (a) and after (b) experiment. During the experiment the crystal stopped showing neutron emission.

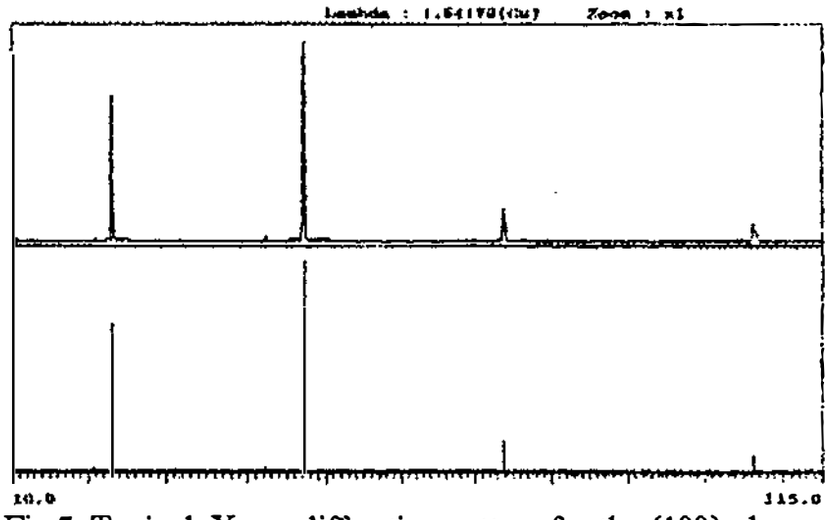


Fig.7. Typical X-ray diffraction pattern for the {100} plane of a cubic sodium tungsten bronze single crystal grown from imperfect seed (before experiment). No positive result.

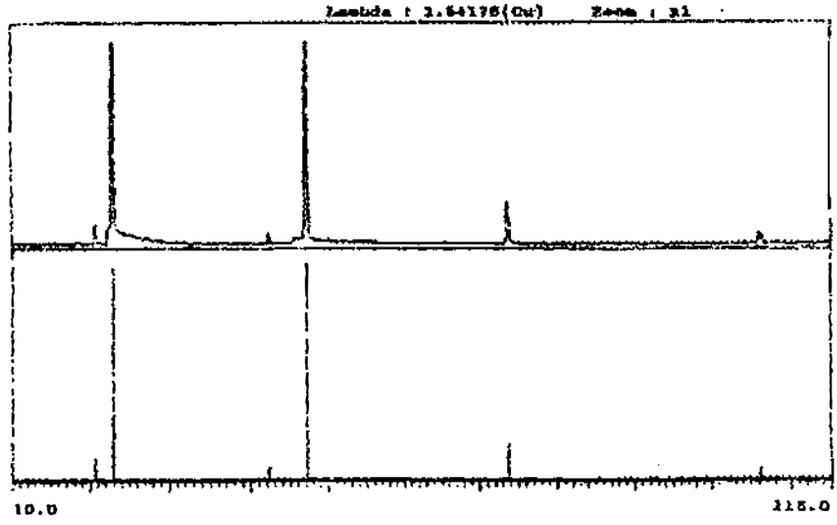


Fig.8. Typical X-ray diffraction pattern for the {100} plane (subjected to polishing and etching) of a cubic tungsten bronze bronze single crystal before experiment. No positive result.