The Sensitizing Phenomenon of X-Ray Film in the Experiment of Metals Loaded with Deuterium

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ABSTRACT

The sensitizing phenomenon of X-ray film was studied, in metals loaded with deuterium, by a cycle method of temperature and pressure (CMTP). The experimental results showed that the sensitization of X-ray film was derived from the chemical reaction and the anomalous effect of metals loaded with deuterium.

1. INTRODUCTION

When Italian A. De. Ninno et al. studied the anomalous phenomenon in metals loaded with deuterium using CMTP, neutrons were detected[1]. When X. Zh. Li et al, from Tsinghua Univ, studied the precursor of the "cold fusion" phenomenon using CMTP, it was fornd that X-ray films were sensitized [2] . To clarify the sensitizing reason of X-ray films, we studied the sensitization phenomenon of X-ray films using CMTP of metals loaded with deuterium. The experimental results show that the sensitizing reasons of X-ray film are derived from the chemical reaction and the anomalous effect of metals loaded with deuterium. Recently R. K. Rout et al. From Bhabha Atomic Research Centra, India, systematically studied the sensitization phenomenon of X-ray films. They considered that low energy electrons emitted in metals loaded with deuterium lead to the sensitization of films[3].

2. EXPERIMENT

2. 1 Experimental Process

Cu and Fe slices were used as contrasting metal to perform blank

runs on the sensitization of X-ray film. Pd and Ti slices loaded with deuterium were used to perform the experiment on the sensitizing effect. Three kinds of metals loaded with deuterium were used: (1) Pd slice (purity 99.6%) 0.5mm in thickness; (2) Ti slice 0.1mm in thicknessl; (3) Pd slice on whose two surface 0.5-μm- thick Ti was evaporated.

Metal slices treated and X-ray films were combined, and then sealed into a copper vessel whose vacuum was at about 10^{-4} torr. Under the condition of the temperature of liquid nitrogen (LN_2), the copper vessel was filled with deuterium gas and the cycle of temperature and pressure (CTP) was done.

2.2 Blank Runs

(1) Air was substituted for deuterium gas. Then CTP was performed. The sensitization of films was not found.

(2) Cu and Fe slices were put between films and the cycle of temperature and pressure was done. It was found that films were sensitized in full area.

(3) Two sets of films were used. One was sealed into a small copper vessel (2mm in thickness, filled with air). The other was put between Cu slices 2mm in thickness and wrapped in Al foil 50 μm in thickness (aerated but opaque). The cycle of temperature and pressure was done. The experimental reaults showed that the first set of films didn't sensitize but the second did, this excluded the possibility that high energy X-rays sensitized films which were produced by bremsstrahlung of high energy γ - rays, X- rays or electrons.

(4) Hydrogen gas was substituted for deuterium gas and then Cu slice was used to perform the experiment as described above. It was found that films also sensitized.

To clarify the reasons of film sensitization in blank run, the checking experiments were done and described below.

2.3 Checking Experiments

Considering the reasons of film sensitization mentioned above, we used only films to perform the checking experiments instead of Cu and Fe slices.

(a) Two sets of films were put into a copper vessel. One was sealed in a black paper bag which was 0.3mm in thickness (opaque, but aerated). The other was put between polyethylene foils 50μm in thickness and wrapped in Al foil 50μm in thickness (opaque, but aerated). When vacuum reached 10^{-4}-5×10^{-5}torr in the copper vessel, oxygen in the copper vessel was excluded by using 6 atm argon was over three times. When vacuum reached 10^{-4}-5×10^{-5} torr in the copper vessel again, deuterium gas was let in and the cycle of temperature and pressure was done. It was found that all the films were sensitized in full area. This excluded the possibility that the combination of deuterium and oxygen sensitized films, which was explained as follows. (i) With vacuum 10^{-4}-5×10^{-5} torr and by the treatment of excluding oxygen by argon gas, quantity of oxygen in gas deuterium was very small. Hence few atoms of deuterium and

oxygen could combine. (ii) The combination of deuterium and oxygen produced on the wall of the tube could emit visible and invisible lights (ultraviolet ray). The lights were shut out by a 50μm-thick polyethylene foil added to a 50μm-thick Al foil and 0. 3mm- thick black paper. If the combination of deuterium and oxygen took place in aluminium oxide, emitted radiation should be shut out by the 50 μm-thick polyethylene foil.

(b) There were two sets of films. One was put in a copper box 3mm in thickness (opaque, but aerated). The other was put between polytetrafluoroethylene 5mm in thickness and wrapped in an Al foil 50μm in thickness (opaque, but aerated). After vacuum was obtained in the copper vessel, it was filled with deuterium gas and the cycle of temperature and pressure was done. It was found that all of the films were sensitized in full area. This excluded the possibility that electrons, X-rays and so on which were emitted owing to Cu absorbing deuterium resulted in the sensitization of films.

By blank run and checking experiment mentioned above, it was excluded that the combination of deuterium and oxygen, and radiation derived from copper and iron absorbing deuterium resulted in the sensitization of films. By the comparion with the experimental conditions of sensitizing and no sensitizing in blank run and checking experiment, it was shown that the reason of film sensitization was that the combiantion of deuterium and Br in film formed DBr and Ag ion was displaced out.

The repeatability of the experiments mentioned above is 100%.

2.4 Experiment of Sensitizing Effect in Metal Loaded with Deuterium

Ti slices and two kinds of Pd slices loaded with deuterium were used to perform the experiment by the cycle of temperature and pressure. One kind of Pd slice was 0. 5mm in thickness and the other was the one plated 0. 5μm Ti on two surfaces. The combination of films and metal loaded with deuterium is shown in Fig. 1.

Experimental results were shown as figures:

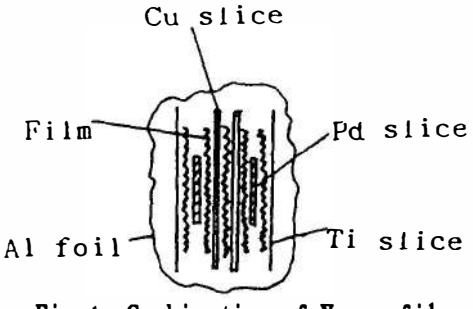

Fig. 1. Combination of X-ray films and the metal slices

Fig. 2. An image of Pd slice

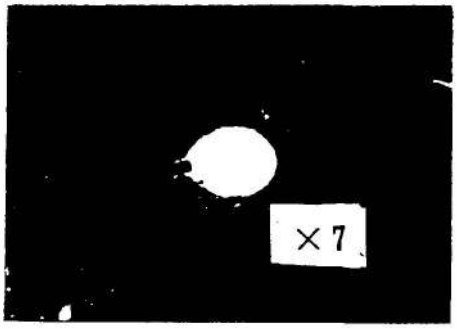

Fig. 3. A sensitized point on a film

Fig. 4. An image of Pd tube

3. DISCUSSIONS

(1) There was an image of Pd slice in full background of sensetized films which were combined with Pd slices. The fac shows that two reasons result in the sensitization of films. One is the chemical reaction. The other is the oneself effect of PaD metal. The even sensitization in full area of films indicates that Br in films chemically react with deuterium. An image of Pd slice in full background of sensitized films indicates that the sensitization is derived from the anomalous effect in Pd slice.

We consider that some effevts in PdD metal may make films sensitize as listed below:

(a) Extraheat and burst heat in PdD metal.

(b) Electron emission in PdD metal.

(c) Br in films reacting with highly active deuterium which was releasted by PdD metal.

(d) Charged particles emitted by PdD metal, electrons and characteristic X-rays imitated by the charged particles.

The sensitizing effect of films in PdD metal will be studied further.

(2) There was a track on the outer membrane of a film, which was formed after Pd slice was peeled off. The track may be a result that Pd slice produced extraheating phenomenon.

(3) There were sensitized points on some films. Do the points indicate whether burst heat was released out in a micro-zone of PdD or lots of deuterium was suddenly released in a micro-zone of PdD?

We consider that the sensitizing effect of films made by PdD metal reflects the anomalous phenomenon in PdD metal. Studying the phenomenon is helpful to understand cold fusion further.

REFERENCES

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