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Effect of Annealing Temperature on the Photoelectric Work Function of Silver-Zinc Oxide Contact Materials

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Abstract : Contact materials used for electrical breakers are often made with silver alloys. Mechanical and thermo dynamical properties as well as electron emission of such complicated alloys present a lack of reliable and accurate experimental data. This paper deals mainly with electron work function (EWF) measurements about silver-metal oxide (Ag-MeO) electrical contacts (Ag-ZnO (92/8), before and after surface heat treatments at 296 K 813 K, under UHV conditions (residual gas pressure of 1.4 x 10-7 mbar). The electron work function (EWF) of silver zinc oxide materials was measured photoelectrically, using both Fowler's method of isothermal curves and linearized Fowler plots. In this paper, we present the development of a method for measuring photoelectric work function of contact materials. Also reported in this manuscript are the results of experimental work whose purpose has been the buildup of a reliable photoelectric system and associated monochromatic ultra-violet radiations source, and the photoelectric measurement of the electron work functions (EWF) of contact materials. In order to study the influence of annealing temperature on the EWF, a vacuum furnace was used for heating the metallic samples up to 800 K. The EWF of the silver – zinc oxide materials were investigated to study the influence of annealing temperature on the EWF. In the present study, the photoelectric measurements about Ag-ZnO(92/8) contacts have shown a linear decrease of the EWF with increasing temperature, i.e. the temperature coefficient is constant and negative: for the first annealing # 1, in the temperature range [299 K 823 K]. On the contrary, a linear increase was observed with increasing temperature (i.e. , being constant and positive), for the next annealing # 2, in the temperature range [296 K 813 K]. The EWFs obtained for silver-zinc oxide Ag-ZnO(92/8) show an obvious dependence on the annealing temperature which is strongly associated with the evolution of the arrangement on ZnO nano particles on the Ag-ZnO contact surface as well as surface charge distribution.

Keywords : Photoemission, Electron work function, Fowler methods, Ag-ZnO contact materials, Vacuum heat treatment
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