Abstract

The present investigation is concerned with the development of a non-CdO type non-toxic material for electrical contact application. Ag-ZnO has been proposed as the replacement material to a more conventional Ag-CdO contact material on the basis of findings of this research work.

A comparative study was undertaken between three different compositions of Ag-CdO and the equivalent Ag-ZnO compositions. The composite powders of Ag-CdO and Ag-ZnO were prepared by different processing routes such as conventional PM route of mixing,spray-coprecipitation method, electroless coating process, freeze-drying route and mechanical alloying. The composite powders so processed were characterized using several techniques such as AAS, XRD, SEM, optical microscopy and particle size analysis. The density, hardness and electrical conductivity measurements; microstructural and morphological examination ; and the electrical performance evaluation was done for consolidated compacts of above process routes. The effect of Lithium addition on Ag10.8ZnO system was also examined.

The powder characterization clearly revealed the possibility of producing powders with good apparent and tap density having controlled levels of Na and K impurities alongwith fine particle size and size distribution by processing routes like spray-coprecipitation, electroless-coating and mechanical alloying. Highly spongy nature and greater microporosity of freeze-dried powders resulted into inferior bulk-properties for these powders. An ideal combination of powder properties was found for MA powders of both Ag-ZnO and Ag-CdO.

The pressed, sintered and hot-pressed compacts of conventional PM route, spray coprecipitation and mechanical alloying offered final density values above 98% of theoretical. They are in close agreement with those reported in the literature. Except conventional PM route, all other process routes gave acceptable values for microhardness. Mechanical alloying gave the maximum microhardness equal to 106 Kg/mm^2. Similarly, acceptable values of electrical conductivity were attained in all the compacts excluding those processed by freeze-drying route.

Electrical performance evaluation for Ag-ZnO and Ag-CdO contacts of selected process routes under different conditions of testing indicated acceptable levels of erosion rate, contact resistance and antiwelding property. The results thus clearly show the feasibility of replacement of toxic Ag-CdO system by an environment-friendly Ag-ZnO system without any reservations.

It is also apparent from the findings for composite powders and consolidated composites of different process routes covered under this investigation that the mechanical alloying process is the best of all. Not only this, because of simplicity of this process, relatively low cost, freedom from usual contaminations and the viability as a commercial process for production of Ag-MeO composite powders, it offers a very high potential as an emerging technology for processing of silver-metal oxide powders for electrical contact applications.

Keywords *: Silver-base contacts, electrical contacts, Ag-CdO and Ag-ZnO composites, powder metallurgy, spray-coprecipitation method, electroless coating route, freeze-drying process, mechanical alloying, electrical life-test.*