List of Figures

Fig.2.1 : Pictorial view of the configurations of commercially used contacts with base-plates.

Fig.2.2 : Schematic view of mechanical alloying set-up alongwith resultant microstructural change

Fig.2.3 : Schematic microstructures of Ag CdO contacts prepared by (a) conventional PM route, (b) internal oxidation process and (c) L-type contacts.

Fig 2.4 : Schematic of (a) laboratory scale freezing set-up and (b) freeze dryer

Fig 2.5 : Diagram showing stages of manufacture of silver-cadmium oxide contacts by internal oxidation.

Fig 2.6 : Diagramatic view of press-sinter-repress route.

Fig 2.7 : Diagramatic view of press-sinter-extrude route

Fig 2.8 : Schematic of roll-compaction technique

Fig 2.9 : Flow-sheet of various processing routes of AgCdO contact material on a comparative basis.

Fig 2.10 : Schematic of (a) principal mechanical components and (b) electrical power circuit of contact test set-up.

Fig 2.11 : Schematic of contact test set-up developed at LCIE - (a) operating parts and (b) electrical circuit diagram.

Fig.2.12 : Schematic of DC contact testing switch

Fig.2.13 : Plot of mean cross-section chord length of oxide particle versus lithium content

Fig.2.14 : Effect of lithium addition on as-sintered density of Ag-CdO contacts.

Fig 2.15 : Arc erosion loss for Ag-CdO-Li₂O and Ag-CdO- Li₂ CO₃ systems.
Fig 3.1: Probability number distribution plot for silver powder.
Fig 3.2: Probability number distribution plot for CdO powder
Fig 3.3: Probability number distribution plot for ZnO powder
Fig 3.4: Schematic of spray-coprecipitation set-up
Fig 3.5: Sketch of the freeze-dryer
Fig 3.6: Photographs showing design aspects of attritor
Fig 3.7: Photograph of the sintering furnace along with temperature programmer controller.
Fig 3.8: Photograph of the hot-pressing set-up
Fig 3.9: Photograph of the contact force measurement set-up.
Fig 3.10: Photograph of the contact testing set-up for a pair of contacts
Fig 3.11: Photograph of the brazed contact tips along with copper lugs
Fig 3.12: Photograph of the test-contactor assembly and a single contact tip shown separately.
Fig 3.13: Circuit diagram of the AC contact testing set-up
Fig 3.14: Pictorial view of the AC contact testing set-up
Fig 3.15: Programme flow-chart for AC contact testing
Fig 3.16: Circuit diagram of the mV measurement set-up
Fig 3.17: Photograph of the DC contact testing set-up
Fig 3.18: Photograph of the brazed-contact assembly tested at NML, Jamshedpur.
Fig 4.1: XRD profile for silver powder
Fig 4.2: XRD profile for cadmium oxide powder
Fig 4.3: XRD profile for zinc oxide powder
Fig 4.4: Multiple XRD profiles for Ag ZnO blended powders
Fig 4.5: Multiple XRD profiles for Ag ZnO coprecipitated powders
Fig 4.6: Multiple XRD profiles for Ag ZnO electroless-coated powders
Fig 4.7: Multiple XRD profiles for Ag ZnO freeze-dried powders
Fig 4.8: Multiple XRD profiles for Ag CdO blended powders
Fig 4.9: Multiple XRD profiles for Ag CdO coprecipitated powders
Fig 4.10: Multiple XRD profiles for Ag CdO electroless-coated powders
Fig 4.11: Multiple XRD profiles for Ag CdO freeze-dried powders
Fig 4.12: Plots of relative peak intensity (\%) of ZnO phase versus milling time for Ag ZnO (MA) powders
Fig 4.13: Plot of relative peak intensity (\%) of CdO phase versus milling time for AgCdO (MA) powders
Fig 4.14: Plot of relative peak intensity (\%) for Ag (200) line versus milling time for Ag ZnO (MA) and Ag CdO (MA) powders
Fig 4.15: Plot of FWHM value for Ag (200) line versus milling time for AgZnO and AgCdO (MA) powders
Fig 4.16: Multiple plots for probability number distribution for Ag 7.1 ZnO system
Fig 4.17: Multiple plots for probability number distribution for Ag 8.6 ZnO system
Fig 4.18: Multiple plots for probability number distribution for Ag 10.8 ZnO system
Fig 4.19: Multiple plots for probability number distribution for Ag 10 CdO system
Fig 4.20: Multiple plots for probability number distribution for Ag 12 CdO system
Fig 4.21: Multiple plots for probability number distribution for Ag 15 CdO system
Fig 4.22: Histograms for apparent and tap density of Ag ZnO powders
Fig 4.23: Histograms for apparent and tap density of Ag CdO powders
Fig 4.24: Histograms for percentage rise in density on tapping for Ag ZnO powders
Fig 4.25: Histograms for percentage rise in density on tapping for Ag CdO powders
Fig 4.26: Optical micrographs for Ag ZnO (MA) powders at different milling times
Fig 4.27: Optical micrographs for Ag CdO (MA) powders at different milling times
Fig 4.28: SEM micrographs for (a) silver, (b) cadmium oxide and (c) zinc oxide powders
Fig 4.29: SEM micrographs for Ag ZnO (B) powders
Fig 4.30: SEM micrographs for Ag CdO (B) powders
Fig 4.31: SEM micrographs for Ag ZnO (C) powders
Fig 4.32: SEM micrographs for Ag CdO (C) powders
Fig 4.33: SEM micrographs for Ag ZnO (F) powders
Fig 4.34: SEM micrographs for Ag CdO (F) powders
Fig 4.35: SEM micrographs for Ag ZnO (E) powders
Fig 4.36: SEM micrographs for Ag CdO (E) powders
Fig 4.37: SEM micrographs for Ag ZnO (MA) and Ag CdO (MA) powders
Fig 4.38: XPS spectra of Ag ZnO (E) powder samples
Fig 4.39: XPS spectra of Ag CdO (E) powder samples
Fig 4.40: DTA / TGA trace for Ag ZnO powder sample
Fig 4.41: DTA / TGA trace for Ag CdO powder sample
Fig 4.42: Variation of density with compaction pressure for Ag 8.6 ZnO (B) system
Fig 4.43: Variation of density with compaction pressure for Ag 12 CdO (B) system
Fig 4.44: Variation of sintered density with sintering temperature for Ag 8.6 ZnO (B) and Ag 12 CdO (B) system
Fig 4.45: Variation of sintered density with sintering time for Ag 8.6 ZnO (B) and Ag 12 CdO (B) system

Fig 4.46: Histograms showing microhardness for Ag ZnO system

Fig 4.47: Histograms showing microhardness for Ag CdO system

Fig 4.48: Variation of electrical conductivity with percent oxide phase for Ag ZnO (B) system

Fig 4.49: Variation of electrical conductivity with percent oxide phase for Ag ZnO (C) system

Fig 4.50: Variation of electrical conductivity with percent oxide phase for Ag ZnO (E) system

Fig 4.51: Variation of electrical conductivity with percent oxide phase for Ag ZnO (F) system

Fig 4.52: Variation of electrical conductivity with percent oxide phase for Ag CdO (B) system

Fig 4.53: Variation of electrical conductivity with percent oxide phase for Ag CdO (C) system

Fig 4.54: Variation of electrical conductivity with percent oxide phase for Ag CdO (E) system

Fig 4.55: Variation of electrical conductivity with percent oxide phase for Ag CdO (F) system

Fig 4.56: Optical micrographs for Ag ZnO (B) samples

Fig 4.57: Optical micrographs for Ag CdO (B) samples

Fig 4.58: Optical micrographs for Ag ZnO (C) samples
Fig 4.59 : Optical micrographs for Ag CdO (C) samples
Fig 4.60 : Optical micrographs for Ag ZnO (E) samples
Fig 4.61 : Optical micrographs for Ag CdO (E) samples
Fig 4.62 : Optical micrographs for Ag ZnO (F) samples
Fig 4.63 : Optical micrographs for Ag CdO (F) samples
Fig 4.64 : Optical micrographs for Ag ZnO (MA) and Ag CdO (MA) samples
Fig 4.65 : Histograms showing % area fraction for ZnO in Ag ZnO compacts for different process routes
Fig 4.66 : Histograms showing % area fraction for CdO in Ag CdO compacts for different process routes
Fig 4.67 : Histograms showing roundness factor for ZnO phase for different process routes
Fig 4.68 : Histograms showing roundness factor for CdO phase for different process routes
Fig 4.69 : Histograms showing feret average for ZnO particles for different process routes
Fig 4.70 : Histograms showing feret average for CdO particles for different process routes
Fig 4.71 : Multiple plots for percentage undersize versus particle size in microns for Li-treated and Li free Ag 10.8 ZnO powder samples.
Fig 4.72 : ESCA profile for Li-treated Ag 10.8 ZnO powder sample
Fig 4.73 : Optical micrographs for Ag 10.8 ZnO final hot-pressed compacts (a) without Li addition and (b) with 1% LiNO₃ addition
Fig 4.74: Variation of contact erosion with make and break operations for Ag 7.1 ZnO (C), Ag 7.1 ZnO (E) and Ag 10CdO (B) contacts.

Fig 4.75: Variation of contact resistance with make and break operations for Ag 7.1 ZnO (C), Ag 7.1 ZnO (E) and Ag 10CdO (B) contacts.

Fig 4.76: Variation of contact erosion with make and break operations for Ag 8.6 - ZnO (C) and Ag 8.6 ZnO (E) contacts.

Fig 4.77: Variation of contact resistance with make and break operations for Ag 8.6 - ZnO (C) and Ag 8.6 ZnO (E) contacts.

Fig 4.78: Histograms showing temperature rise for Ag 8.6 ZnO (C) and Ag 8.6 ZnO (E) contacts at different time intervals.

Fig 4.79: Variation of contact erosion with make and break operations for Ag 10.8 ZnO (C) and Ag 10.8 ZnO (E) contacts.

Fig 4.80: Variation of contact resistance with make and break operations for Ag 10.8 ZnO (C) and Ag 10.8 ZnO (E) contacts.

Fig 4.81: Variation of contact erosion with make and break operations for Ag 10.8 ZnO (MA) and Ag 15CdO (MA) contacts in DC mode.

Fig 4.82: Variation of contact resistance with make and break operations for Ag 10.8 ZnO (MA) and Ag 15CdO (MA) contacts in DC mode.