GENERAL CONCLUSIONS

Various pure metals such as gold, silver, copper, aluminium, lead, tin etc. are commonly used as electrode materials. In the fabrication of circuit elements, these are usually vacuum deposited or sputtered onto insulating bases. These films are expected to maintain their desired properties constant during device operation. The properties which are important from the point of view of its electrical applications are the mechanical stability and strength, thermal stability and resistance to ageing, structural stability and resistance to surface oxidation, etc. In an attempt to achieve these requirements for contact materials, studies have been carried out to investigate the effect of various additives on the properties of pure metals.

The chromium-copper alloys are widely used as contact material as a substitute for pure copper. It is observed that the addition of chromium to copper leads to the formation of solid solutions when the chromium content is small (less than 1%).
It is observed that such an addition also results in the modification of certain physical properties of relevance to electrical technology.

The data available on the properties of chromium-copper alloys is limited to allow its full utilization for potential applications. However, it has been observed that the presence of chromium in bulk copper increases the electrical resistivity. No report on the structure or any other physical property of the alloy is available till to-date on thin film samples of the alloy. Hence a careful and detailed study of the alloy and its properties was undertaken.

The present study is restricted to an alloy with a chromium content 0.8% by weight which finds commercial use in the bulk form. Thin film samples of this alloy were prepared by vacuum evaporation and its properties were studied. A structural study of the bulk alloy with x-ray diffraction and of thin films with electron diffraction revealed that the alloy has an f.c.c. structure with a lattice parameter of 3.48 Å. The chemical composition could be confirmed
with the help of Energy Dispersive Analysis of X-rays.
A study of the effect of various growth parameters like the deposition rate, source temperature, nature of the substrate etc., revealed that the deposited films are essentially polycrystalline with no preferred directions. This ensures the reproducibility of particular electrical characteristics on various support materials. It is observed that the preferential ageing temperature for the alloy (190°C) lies close to that of copper (175°C).

A study of the electrical resistivity and its temperature coefficient shows that the alloy is metallic in behaviour and can be considered to be a simple, dilute solution. Even though the resistivity of the alloy films is higher than that of pure copper, the temperature coefficient of resistance of the alloy films is found to be considerably less, making it more useful for an operation over a range of temperature.

A study of the junction properties of the alloy with various metal films reveals that the alloy provides an ohmic contact with the metals. The annealed alloy electrodes form sharp junctions.
without interdiffusion. The variation of the junction resistance is also less as compared to that obtained with other electrodes.

The mechanical behaviour of the alloy films is quite encouraging with a better hardness and improved adhesion of the film to the substrate than copper films.

These results demonstrate unambiguously the superiority of the alloy films as electrodes in electronic integrated circuits over copper films.