

THREADING on SLIP RINGS

The most frequent and best known causes of threading on slip rings are operation of the machines with improper brush grades, abrasive dust, presence of oil, chemical attack or brush grades poorly adapted to the speed of the machine. In addition, structural defects are sometimes found in the metal of the slip rings.

These defects are easy to detect especially in the copper-tin bronzes, if an appropriate metallo-graphical bench is available and if the techniques for polishing and etching metals and alloys are known.

The rapid wear and threading of copper-tin bronzes result from three definitive types of defects:

- Inside porosity or blowholes due either to gas bubbles enclosed in the metal during solidification or from cracks due to a defective casting process (fig. 1).
- Dendritic structure which appears under the microscope as “fish bones” and denotes a lack of homogeneity of the solid solution (fig. 2).
- Existence of isolated crystals in the α phase, generally small but with hardness higher than that of the matrix in the area in which they have grown. These crystals are rich in tin (δ and sometimes ϵ phase) and appear during the solidification when the cooling speed is excessive; they have not been dissolved during the annealing procedure (fig. 3).

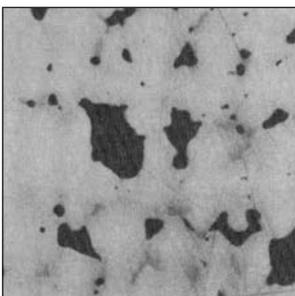


Fig. 1

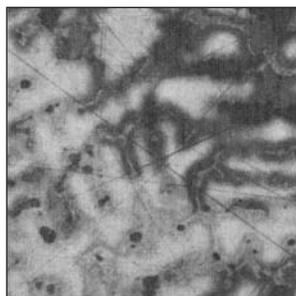


Fig. 2



Fig. 3

An annealing treatment (performed to make the material more homogeneous) at too high a temperature, above that of the solid solution, can lead to a burning of the metal and formation of the δ component at the joint of the crystals together with micro cracks.

Apart from these structural defects which have undesirable effects on the operation of the brushes, the action of two impurities frequently found in bronzes used in friction applications should also be mentioned:

- Lead over 0.05 % when it is in a free state in the alloy. Because of lead's low melting point it exudes at quite low temperatures and creates along the friction tracks a surface porosity which in turn gives a rough metal surface. Therefore it is really undesirable in case of applications where the slip rings are turning quickly and are subject to permanent high heatings.
- Aluminium which when over 1 % is unsuitable because its oxide is abrasive and sometimes causes rapid wear of the brushes.



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