SWEATING, PHOSPHIDE SWEAT, TIN SWEAT, LEAD SWEAT

Smooth-surfaced metallic projections which are nearly spherical in shape, found on casting surfaces which have not been in contact with the mold (open-faced molds, centrifugal molds). The beads are generally of different composition than that of the base metal. In precision castings the defect occurs most often in reentrant angles, blind holes and undercuts.

Possible Causes and Suggested Remedies

— Cast Iron

The eutectic which occurs at grain boundaries at the end of solidification can be oxidized towards free surfaces of the casting (open molds or the interior of centrifugally-cast pipe) due to the pressures which may develop by eutectic graphitization, evolution of dissolved gas, or the contraction of the solidified portion of the casting.

In the case of cast iron, the droplets are generally richer in phosphorus than the mass of the casting, hence their name.

When this exudation of eutectic liquid occurs inside a blowhole or other internal defect, the defect is classified as an inclusion (G 115).

In general it is unnecessary to take remedial action.

— Light Metals

The defect can be caused by a heat treatment where the temperature exceeds the solidus temperature.

Heat treating conditions, in such cases, should be verified.

— Copper-Base Alloys

In copper alloys it is generally the pressure caused by the release of dissolved gases which gives rise to this defect; hence there may also be macroporosity. Contraction of solidified portions of the casting can also play a role in the formation of the defect.

The most important remedy is to avoid gas contamination of the molten metal.

Precision Casting (expandable patterns): All metals.

In precision investment casting with expendable patterns, air bubbles can lodge in the dip coat or backup layer if these are not applied correctly or if the orientation of the patterns on the cluster has a tendency to cause bubble entrapping. The dip coat layer is broken through during casting and the air bubbles become filled with metal.

The remedy is to use proper precautions during dipping and coating.

A 311 - Cast Iron, Centrifugally-cast

Fragment of high-phosphorus cast iron pipe showing phosphide sweat. Internal pressure during solidification due to graphitization or gas evolution favors the occurrence of this defect, as does a high phosphorus content.

A 311 - Aluminum Alloy, Permanent Molded

Aluminum alloy cylinder head showing sweating.

Remedy: Lower the temperature of the heat treating furnace to its normal value.

(Further examples p. 80)