

## Crimp pins made from Copper alloys containing Zinc

For electric contacts and crimp pins, typically Copper alloys are used, some of them contain Zinc. According standard vacuum knowledge, Zinc itself should not be used in UHV applications, as the vapour pressure is high.

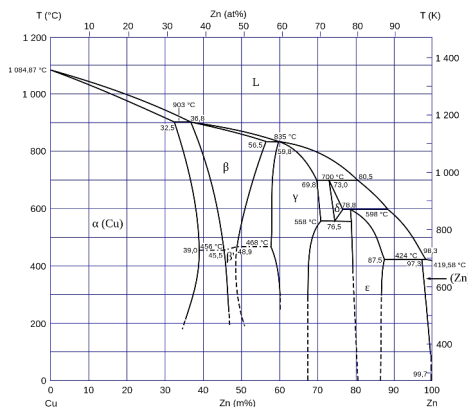
1) Fact is, that up to  $\sim 110^{\circ}\text{C}$ , the vapour pressure of pure Zinc is very low and comparable to other metals used in vacuum:

Table 4  
Outgassing rates of some metals

Metal	Mol. weight	Temperature (K)	Evaporation rate, ( $\text{kg}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ )
Cd	112.4	340	$2.50\cdot 10^{-11}$
Zn	65.37	390	$1.70\cdot 10^{-11}$
Ca	40.08	550	$1.18\cdot 10^{-11}$
In	114.82	760	$1.70\cdot 10^{-11}$
Ag	107.87	830	$5.70\cdot 10^{-12}$
Cu	63.54	990	$1.10\cdot 10^{-11}$
Pt	195.09	1550	$1.55\cdot 10^{-11}$
Ti	47.96	1400	$8.10\cdot 10^{-11}$
Nb	92.906	2050	$9.30\cdot 10^{-12}$
Ta	180.948	2300	$1.23\cdot 10^{-11}$
W	183.85	2400	$1.20\cdot 10^{-11}$

(Source: PHYSICS OF OUTGASSING, J.L. de Segovia, Instituto de Física Aplicada, CETEF "L. Torres Quevedo", CSIC, Madrid, Spain; published by CERN)

2) Copper alloys like Brass contain typically 40% of Zinc. Both metals form a substitutional solid solution, which means, that Cu and Zn form together a crystal structure, in which the atoms are randomly either Cu or Zn. The Zinc atoms are not free to evaporate at  $\sim 420^{\circ}\text{C}$  but are now part of an alloy with a melting point of approx.  $850^{\circ}\text{C}$ .



Phase diagram of the Cu-Zn system

3) Pins made out of copper alloys for vacuum applications are always coated. The most common coating material is nickel. This layer is a barrier for diffusion, so neither Cu nor Zn can segregate to the surface of the pin.

4) For high mechanical and electrical strength, in addition all pins are gold plated. The nickel layer also works here to avoid diffusion of the gold layer into the pin material.

With the above knowledge it is clear, that a pin made out of "Brass" is not the same as an item made out of Zinc or is Zinc coated. By the coating with Nickel and Gold the item has an outgassing similar to a pure Gold item.

Internal comparison tests of female pins (Zinc free) with male pins (Cu alloy with Zinc) showed no measurable difference in outgassing within the limits of our measurement system.

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Female Sub-D pins contain no Zinc  
Male Sub-D pins contain Zinc in the base material.

All pins are Gold plated over Nickel.  
Standard plating thickness is 0,2 $\mu$ m Au