NEW Hg DISPENSERS FOR COLD CATHODE LAMPS

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1. INTRODUCTION

Cold Cathode Fluorescent Lamps (CCFL) need 1-3 mg of mercury for operating. The worldwide growing ecological sensitivity and local environmental policies are pushing lamp manufacturers to progressively reduce the absolute value of Hg dose and its fluctuations as much as possible.
A suitable and reliable technology for Hg dispensation is necessary to meet these requirements.
St505 is a Ti-Hg intermetallic compound, originally developed by SAES Getters and it has found widespread application for Hg dosing in fluorescent lamps, especially in its High Yield (HY) version *[1,2]*. St505 is stable and has a very low Hg vapour pressure at room temperature. Mercury is released only when St505 is heated up to a suitably high temperature for few seconds in the sealed lamps.

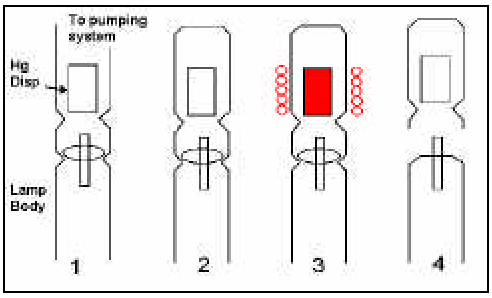
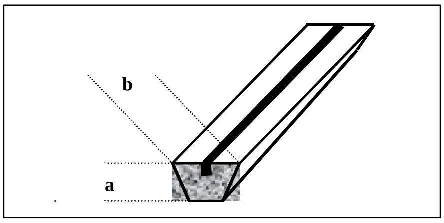


Fig.1 – Double tip-off technology for CCFL production

A dispenser based on St505 can meet all the constraints set by the double tip-off technology, now a sort of standard for CCFL production. Main steps of double tip-off technology are summarized in Fig.1. The Hg dispenser is mounted in the pumping tubulation and must withstand lamp baking conditions (1). Then the glass pipe is filled with Ne/Ar (few thousand Pa of pressure) and a first tip-off is performed to isolate the lamp and the Hg dispenser from the pumping system (2). At this point the dispenser is activated in few seconds (3). Finally a second tip-off is performed (4); the lamp is sealed and definitively separated from the activated Hg dispenser, which is disposed.

2. Hg DISPENSERS: CONFIGURATION AND MAIN FEATURES

The Hg dispensers for CCFL have been developed meeting the above mentioned constraints and requirements. *Sthgs/Wire* consists in a metal sheath enclosing a powder mixture of Hg dispensing alloy (St505) and getter material, a Zr-Al alloy (with the trade name of St101), as shown in Fig.2.
The dispenser has a wire configuration with a trapezoidal cross section and a longitudinal slit to allow a quick release of mercury.



	Dimensions (mm)	Hg content (mg/mm)
STHGS/WIRE 0.6	a = 0.60 b = 0.75	0.46
STHGS/WIRE 0.8	a = 0.85 b = 1.00	0.80

Fig. 2: Hg wire dispensers

Dimensions and Hg content of the *Sthgs/wire* are indicated in Fig.2; the fluctuation of the mercury content is less than ±7%. These dispensers are usually provided with typical length of 300 mm. Depending on the required Hg content few mm long pieces are cut and inserted into the lamp pumping tubulation.
Hg yield characteristics of the *Sthgs/Wire* have been studied by heating samples in an evacuated system at different temperatures: the amounts of released Hg have been determined by weight difference. The wires have been heated according to the following schedule: ramp up time of 10 s to achieve the maximum temperature and maintenance of 20 s at the maximum temperature. Chemical analyses have been performed to measure the residual Hg in the activated samples.
Typical yield curves are plotted in Fig. 3, where the ratio “released Hg/total Hg” and amount of released Hg are reported as a function of the maximum temperature achieved during activation.

The data refer to wires with a Hg content of 0.80 mg/mm. As one can see, a Hg yield of about 80% is obtained activating at 900°C for 30 s; in these conditions about 2.0 mg of Hg can be easily dosed in lamp using a 3 mm long piece.
Specific tests have been carried out to check the thermal stability of the St505, submitting the wires to typical conditions of a baking process: samples have been heated in vacuum at 450°C and at 500°C for 2 minutes and Hg release has resulted below the sensitivity of the technique (lower than 0.2% of the total mercury content).
It has to be pointed out that, immediately after activation, the St101 present in the structure can efficiently sorb possible gas impurities released while heating the dispenser, or originally present in the filling mixture.

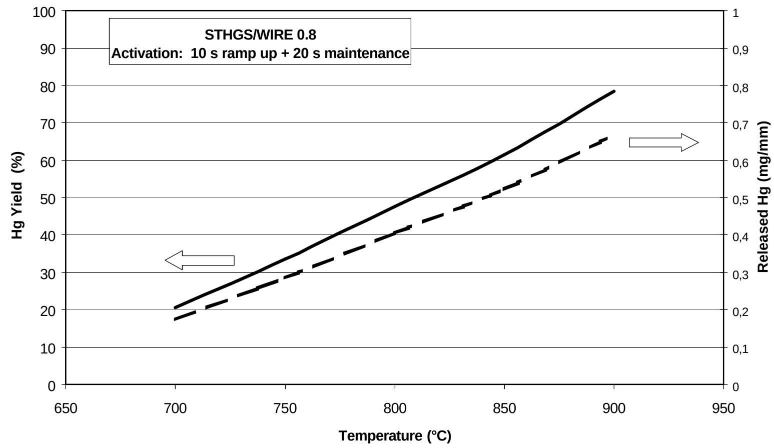


Fig. 3: Typical Hg Yield curve for a Sthgs/Wire

A new version of wires with total mercury yield characteristics is under development: a special HY mixture has been optimized by mixing a suitable Cu-based promoter with the St505 powder. Above 750°C an interaction occurs between the promoter and the titanium present in the St505, enabling mercury release with very high yield. On the other side it has been demonstrated that the mixture doesn't release mercury up to 600°C. Fig. 4 shows a preliminary yield curve: more than 95% of the Hg is released by heating in a temperature range of 800-900°C. Below 750°C the yield curves for the *Sthgs/wires* and for HY wires are similar as the promoter exerts its action above this temperature. Being the upper part of yield curve flat, Hg yield is relatively independent of the maximum temperature achieved during the activation process. As the St101 can interfere with the interaction between St505 and promoter the getter is not integrated in the HY wire structure. HY wires are being optimized to take into account specific demands of lamp production processes.

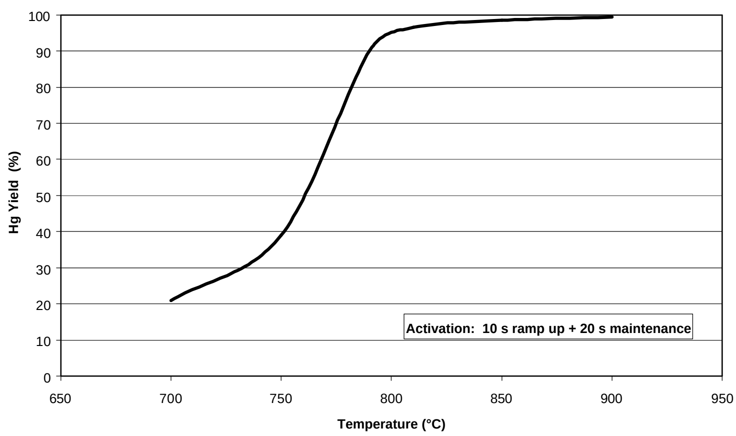


Fig. 4: Hg Yield curve for a wire containing a High Yield mixture

3. CONCLUSIONS

The St505 based dispensers with a wire configuration are a simple and reliable solution to precisely dose mercury in CCFL. A gettering action is also provided from the Zr-Al alloy that allows a significant reduction of the impurities level in the gas mixture.

4. ACKNOWLEDGEMENTS

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5. REFERENCES

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