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SAES Getters S.p.A.
1.0 Introduction

In order to meet the technological requirements of more sophisticated applications, new nonevaporable getters (NEGs) have been developed by SAES Getters. The research and development work has led to a new family of porous getters with the following characteristics:

- High sorption capacity
- High mechanical stability
- Activatable at relatively low temperatures (around 500°C)
- Capable of withstanding air baking
- High capacity for H2 without embrittlement problems

The new material is identified with the code St 175.

2.0 St 175 Materials

St 175 getters are made of a porous mixture of titanium and molybdenum powders. The St 175 material is lightly pressed and sintered following a proprietary technology that, while maintaining sufficient porosity, gives the getter good mechanical stability. It is possible to use the St 175 getter material with holders made of Nichrome. The good adhesion between the getter material and the container is due to a controlled reaction between the titanium and the metal holder.

3.0 St 175 Getter Activation and Sorption Characteristics

The getter, compared to other nonevaporable getter materials, has better sorption characteristics as the sorption temperature increases. However, due to its porosity, this getter has good sorption performance even at room temperature.

4.0 Standard Activation

The activation of this getter must be done under vacuum, heating the getter material for a recommended time at a prescribed temperature. Nevertheless, activation conditions are not rigid, and activation parameters can be chosen within a wide range of values.

St 175 can reach a satisfactory degree of activation after a treatment of 500°C for 10 minutes. For example, specific sorption tests for the St 175/W/15-6-2/200 getter activated under these conditions, for both CO and H2, are reported in fig. 1.
When the bakeout treatment of the tubes in which the getter is mounted is in the range of 350 to 450°C, it is possible to perform simultaneous tube bakeout and getter activation. During the tube bakeout, the pressure should be below $10^{-3}$ torr.

St 175 getters can also be conveniently used during bakeout of the tubes as an internal pump. In this way, the getter works in combination with the main pumping system, shortening the total processing time of the device.

### 5.0 High Temperature Activation

An improvement of the sorption characteristics of St 175 with respect to that obtained with an activation of 500°C for 10 minutes is performing activation at 900°C for 10 minutes. Sorption curves obtained for getters so treated are reported in fig. 2.
6.0 Sorption of Gases by St 175 Getters

St 175 getters sorb gases via different mechanisms:
- CO, CO₂, N₂ and O₂ are chemically sorbed by the getter and permanently trapped
- H₂ is reversibly sorbed by the getter

H₂ forms a solid solution with the getter material and is released when the getter temperature is increased depending on its concentration in the getter material. The relationship between H₂ concentration, temperature and equilibrium pressure is given in fig. 3.

The equilibrium pressure can be described by the following expression (Sieverts Law):

\[
\text{St 175: } \log P = 3.703 + 2 \log Q - 5287 \frac{1}{T}
\]

where:
- \( P \) = Equilibrium pressure (torr)
- \( Q \) = H₂ concentration (cc torr/mg)
- \( T \) = Absolute temperature (K)

- CH₄ is sorbed at high temperatures
- Rare gases are not sorbed

7.0 Resistance to High Hydrogen Load

Tests have shown the good resistance of St 175 getters to high concentrations of sorbed H₂. No embrittlement problems occur until at least 50 cc torr/mg of H₂ have been sorbed by the getter.
8.0 Resistance of St 175 Getters to Air Baking

This type of getter can withstand heat treatment in air up to 400°C without drastic deterioration of gettering performance. This is shown in fig. 4 where the behavior of an St 175 getter baked in air at 400°C for 1 hour and then activated at 900°C for 10 minutes is shown.

As expected, the resulting gettering characteristics are quite similar to those of a fresh getter (dashed curves in fig. 4).

\[ \text{Fig. 4: Sorption performance after air baking at 400°C} \]

9.0 Types of Getters Available

St 175 getters are available with Nichrome holders, as shown in fig. 5. As standard products, St 175 getters are available as pills or washers of various dimensions, as shown in fig. 6.

\[ \text{Fig. 5} \]

\[ \text{Fig. 6} \]
The SAES Getters Group manufacturing companies are ISO9001 certified, the Asian and Italian companies are ISO14001 certified also. Full information about our certifications for each company of the Group is available on our website at: www.saes-getters.com

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