Our competitive advantages:

- Long lifetime dispensers cathodes
- Electron gun manufacturing capability
- High capacity getters for high vacuum requirements
- Customizing high purity and controlled purity materials
- Bespoke configurations for cathodes and getters
- Residual gas analyses capability
Dispenser Cathodes

SAES is supplying dispenser cathodes leveraging the 50 years experience in manufacturing and technology of Spectra-Mat Inc. Our vertically integrated manufacturing line assures full quality control of every step of the manufacturing process.

Getters

Getter materials manufactured by SAES have represented the industry standard for decades and, originally developed also for the X-ray applications, offer unique advantages to solve the getter requirements in the actual X-ray tubes. The getter materials are well suited for the actual X-ray tubes, providing long lifetime and high reliability.

Solutions for X-ray Tubes

High Reliability Cathodes and Getters

An X-ray tube requires a long-lived, stable and uniform electron emission source to guarantee an output radiation of the desired performance. This in particular is valid for X-ray devices with micro focus capabilities for medical, industrial and scientific applications also requiring highly focused and small diameter electron beams generated by a suitable dispenser cathode. In order to ensure lifetime, reliability and performance, high-purity getters are high capacity micro pumps which ensure the expected level of vacuum in last generation devices and enable the device performance.

Dispensers

High Porosity Getters
Dispenser Cathodes

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Getters

SAES' getter materials have represented the industry standard for decades and, originally developed specifically for X-ray tubes, they are now also used for other demanding applications. SAES' getter family is a complete range of high performance getters, capable of optimizing the X-ray tubes and of being used in a wide range of applications, from medical to industrial processing.

Solutions for X-ray Tubes

High Reliability Cathodes and Getters

An X-ray tube requires a long-lived, stable and uniform electron emission source to produce radiation of the desired performance. This is particularly true for X-ray devices with extremely high image resolutions and narrow focus capabilities. In addition, in medical and scientific applications also require highly focused and small diameter arrival beams generated by a suitable dispersive cathode. Therefore, acquiring the correct environment inside the tube is a major step in the X-ray tube manufacturing process.

SAES' cathodes are engineered to optimize the X-ray tube characteristics, ensuring the required level of vacuum in last generation devices and enable the device performance.

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The SAES Group manufacturing companies are ISO9001 certified, the Asian and Italian companies are ISO14001 certified also. Full information about certifications for each company of the Group is available on the corporate website at: www.saesgroup.com

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Our competitive advantages:
- Long lifetime dispensers cathodes
- Electron gun manufacturing capability
- High capacity getters for high vacuum requirements
- Extensive library of controlled purity materials
- Bespoke configurations for adduction and getters
- Residual gas analysis capability
The SAES Group manufacturing companies are ISO9001 certified; the Asian and Italian companies are ISO14001 certified also. Full information about certifications for each company of the Group is available on the corporate website at: www.saesgroup.com

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Our competitive advantages:
- Long lifetime dispensers cathodes
- Electron gun manufacturing capability
- High capacity getters for high vacuum requirements
- Processing high and controlled purity materials
- Bespoke configurations for cathodes and getters
- Residual gas analyses capability

Solutions for X-ray Tubes
Porous getters alloys ST171®, ST172®, ST175®, realized in a broad variety of configurations, with or without embedded heater are the ideal solution for high-end X-ray tubes, where:

- a barium getter film cannot be deposited or it is undesirable
- a large getter mass in a small volume is needed
- loose particles cannot be tolerated
- a high gettering activity for O₂, H₂O, CO, CO₂ and N₂ at room temperature is required
- extremely large amounts of H₂ are to be reversibly sorbed

Sorption mechanisms of the getters towards different elements are resumed in Table 1.

<table>
<thead>
<tr>
<th>Sorption Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CO, CO₂, N₂, O₂</td>
<td>Irreversible</td>
</tr>
<tr>
<td>H₂</td>
<td>Reversible</td>
</tr>
<tr>
<td>H₂O</td>
<td>As Hydrogen and Oxygen</td>
</tr>
<tr>
<td>Hydrocarbons</td>
<td>As Hydrogen and Carbon</td>
</tr>
<tr>
<td>T &gt; 300 °C</td>
<td></td>
</tr>
<tr>
<td>Rare Gases</td>
<td>No pumping</td>
</tr>
</tbody>
</table>

To address the specific requirements of application and the manufacturing process of a X-ray tube, porous getters are available in various shapes and configurations to fit different geometries (as some examples reported in figure below), they can perform an action of in-situ pumping, overcoming geometrical constraints imposed by the system structure. Moreover, a getter is characterized by a continuous working, even in case of power failure.
In the choice of the right alloy, several aspects have to be considered. Materials, internal volumes, vibrations during life of the devices and thermal processes adopted during the manufacturing operation are all factors to look at when choosing the type and sizing the getter. As a partial overview, the guidelines listed on Table 2 apply:

<table>
<thead>
<tr>
<th>St 171</th>
<th>St 172</th>
<th>St 175</th>
</tr>
</thead>
<tbody>
<tr>
<td>High temperature activation</td>
<td>Low temperature activation</td>
<td>Low temperature activation</td>
</tr>
<tr>
<td>Getter not activated during bakeout</td>
<td>Getter can be activated by bakeout</td>
<td>Getter can be activated by bakeout</td>
</tr>
<tr>
<td>Sealing of glass tube does not consume getter</td>
<td>Getter acting as an internal minipump either during tube processing or tube operation</td>
<td>Getter serves as in-situ pump during bakeout</td>
</tr>
<tr>
<td>Getter capacity preserved for tube life</td>
<td>Getter can withstand air baking at temperatures of up to 400°C without dramatic deterioration of gettering performance</td>
<td>High capacity for Hydrogen without embrittlement</td>
</tr>
</tbody>
</table>

The performance (gettering rate and capacity) of a getter is enhanced if it’s placed in a ‘hot’ position. In Rotating Anode X-ray tubes, this is typically the case when the getters are placed behind the anode, protected by direct heat radiation. In the figure below, sorption curves measured from 25°C to 400°C according to ASTM Standard F 798-82 are reported, for an example model of ST172 alloy.
A basic dispenser cathode suitable for X-ray tube use is shown in the figure below: the cathode has no specific mounting structure and requires a “drop-in” heater for operation. As simple a design as it is, this is a quick “drop-in” part, available both for prototyping and long runs.

Depending on X-ray device size, shape, performance requirements and manufacturing processes, SAES can supply dispenser cathodes with the electron emitting areas of different diameters and shapes as shown below; or, we can design around your specific requirements.
SAES can supply a “drop in” dispenser cathode for x rays device by adding a potted heater together with external sleeves to optimize thermal isolation of the cathodes. A three hole mounting base may also be attached, to simplify mounting by the customer.

<table>
<thead>
<tr>
<th>Tip diameter</th>
<th>Unpotted X-ray cathodes</th>
<th>Potted X-ray cathodes</th>
<th>Potted with sleeves X-ray cathodes</th>
<th>Potted with sleeves and base X-ray cathodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ø.098 [2.5 mm]</td>
<td>112-600</td>
<td>112-610</td>
<td>112-620</td>
<td>112-630</td>
</tr>
<tr>
<td>Ø.020 [0.5 mm]</td>
<td>112-602</td>
<td>112-612</td>
<td>112-622</td>
<td>112-632</td>
</tr>
<tr>
<td>Ø.039 [1 mm]</td>
<td>112-604</td>
<td>112-614</td>
<td>112-624</td>
<td>112-634</td>
</tr>
<tr>
<td>Ø.059 [1.5 mm]</td>
<td>112-606</td>
<td>112-616</td>
<td>112-626</td>
<td>112-636</td>
</tr>
</tbody>
</table>

HB Series – Emitter / Body / Heater / Sleeve / Base

Typical values for 1126HB product line are a temperature in the range of 1000°C C at 4.0 volts and .65 amperes. SAES measures before shipment and provides V-I-T data for the design or by part.

The optimal performance of dispenser cathodes is achieved in the high vacuum conditions guaranteed by the use of getters inside the X-ray tube.