

## TB-160 CATHODE COATINGS

### DESCRIPTION

HeatWave Labs' double and triple carbonates are specially prepared electronic materials used for efficient thermal electron emission of cathode structures. These carbonates are compounds of Ba, Sr, and Ca, occurring as homogenous crystallites with an isomorphous crystal structure, carefully dispersed in a lacquer vehicle. Furthermore, the vehicle contains an improved ethyl cellulose binder to create a highly stable lacquer spray coating. An electrophoretic cathode coating is also offered. These coatings can be applied to various geometric hot cathode structures--filamentary, cylindrical, disk, hollow, etc.

Upon heating (breakdown), the carbonate coatings are converted to semiconductor oxides of Ba, Sr, and Ca. These oxides are characteristically N-type and exhibit high electron conductivity paralleling the high functional activity of the hot cathodes. In addition, the pore structure produced from these carbonate coatings is optimized to augment emission and conductivity.

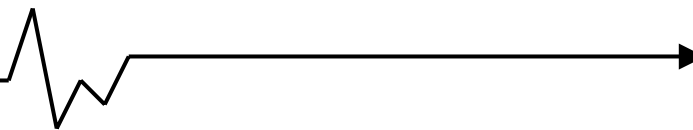
### CATHODE COATING TYPES:

<b>CATHODE COATING - 100</b> high calcium triple carbonate spray coating	(Ba-Sr-Ca) CO <sub>3</sub> 56-31-13%
<b>CATHODE COATING - 200</b> high calcium, high density, triple carbonate spray coating	(Ba-Sr-Ca) CO <sub>3</sub> 56-31-13%
<b>CATHODE COATING - 300</b> low calcium, triple carbonate spray coating	(Ba-Sr-Ca) CO <sub>3</sub> 57-39-4%
<b>CATHODE COATING - 400</b> low calcium, high density, triple carbonate spray coating	(Ba-Sr-Ca) CO <sub>3</sub> 57-39-4%
<b>CATHODE COATING - 500</b> high density, barium and strontium carbonates spray coating	Equimolar BaCO <sub>3</sub> .SrCO <sub>3</sub>
<b>CATHODE COATING - 600</b> high density, barium and strontium carbonate electrophoretic coating.	Equimolar BaCO <sub>3</sub> .SrCO <sub>3</sub>
<b>CATHODE COATING - 700</b> high density, triple carbonate	(Ba-Sr-Ca) 57-39-4%

### APPLICATIONS

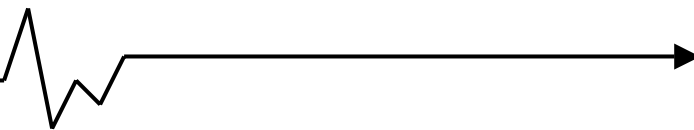
HeatWave Labs Cathode Coatings offer selection of materials to best satisfy requirements for electron emissive surfaces in radio tubes, TV and cathode ray tubes, power tubes, thyratrons, Klystrons, TWTs, and other electron devices. Cathode Coating - 100 is for general-purpose applications. Cathode Coating - 200 and - 400 are recommended where grid-to-cathode spacing must be held very closely. Cathode Coating - 300 and - 400 permit cathodes to be operated at elevated temperatures; while tube transconductance shows excellent stability during life. Cathode Coating - 500 is useful when arc prevention is essential. Cathode coating - 600 and - 700 are electrophoretic types designed to achieve very high packing density of emission carbonates.

Special emission coatings are also available or can be developed for particular applications and requirements. These special products include coatings for catophoresis, dip, and automatic or hand spray methods.



## TB-161 CHARACTERISTICS OF SPRAY CATHODE COATINGS

Type	Product Description	Solids As Carbonates	Percent Composition of Carbonates	Vehicle Binder	Diluent	Zahn Viscosity #1 (seconds)
CATHODE COATING-100	High calcium triple carbonate spray coating	44% W/V	56% BaCO <sub>3</sub> 31% SrCO <sub>3</sub> 13% CaCO <sub>3</sub>	Ethyl Cellulose	85% Xylol-15% Butanol mixture	32
CATHODE COATING-200	High calcium high density triple carbonate spray coating	22% W/V	56% BaCO <sub>3</sub> 31% SrCO <sub>3</sub> 13% CaCO <sub>3</sub>	Ethyl Cellulose	85% Xylol-15% Butanol mixture	32
CATHODE COATING-300	Low calcium triple carbonate spray coating	44% W/V	57% BaCO <sub>3</sub> 39% SrCO <sub>3</sub> 4% CaCO <sub>3</sub>	Ethyl Cellulose	85% Xylol-15% Butanol mixture	32
CATHODE COATING-400	Low calcium high density triple carbonate spray coating	22% W/V	57% BaCO <sub>3</sub> 39% SrCO <sub>3</sub> 4% CaCO <sub>3</sub>	Ethyl Cellulose	85% Xylol-15% Butanol mixture	32
CATHODE COATING-500	Low density barium and strontium carbonates spray coating	44% W/V	57.5% BaCO <sub>3</sub> 42.5% SrCO <sub>3</sub>	Ethyl Cellulose	85% Xylol-15% Butanol mixture	32



**TB-162**

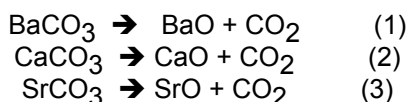
**PROCESS FOR ACTIVATION OF OXIDE CATHODES**  
(Double and Triple Carbonates Cathode Coatings)

The activation process described herein pertains to HeatWave Labs' Cathode Coatings, Types -100, -200, -300, -400, and -500. The basic process is quite conventional and involves heating in vacuo to obtain the essential "breakdown" of cathodes. The process involves four operational steps as follows:

1. Dissipation and removal of ethyl cellulose binder as volatile products.
2. Conversion of the carbonates into the corresponding oxides by thermal degradation.
3. Partial reduction of oxides by dissociation at the metal-coating interface to form free barium, with uniform dispersion of free barium resulting.
4. Cathode stabilization.

The activation process begins by cathode heating to about 500°C for a few minutes under vacuum (at least 10<sup>-5</sup> mm Hg.). The heat input is increased to raise the temperature close to 600°C. The cathode coating will change in color during the heating process becoming gray or black and finally pure white.

The temperature of the heated cathodes should then be increased by control of the heater wattage. The temperature should be increased by control of the heater wattage. The temperature should rise to approximately 900°C, to obtain complete conversion of the carbonates to oxide, e.g:



Complete conversion of the carbonates to oxides will be indicated by the sharp drop in pressure to 10<sup>-6</sup> mm of Hg.

Final activation is then carried out by raising the cathode temperature up to 1200°C, but not higher. At this high temperature some barium is produced forming active cathode structures.

Stabilization is generally obtained by applying a DC voltage to draw a cathode current of 25-50 ma/cm<sup>2</sup> for a short time. The temperature is then reduced to 800°C.

# HeatWave Labs, Inc.

195 Aviation Way, Suite 100  
Watsonville, CA 95076-2069  
831-722-9081 Fax 831-722-5491

E-Mail: <mailto:techsales@cathode.com>

## TB-163 CATHODE COATINGS, RCA Equivalent

CATHODE COATING NO.	CARBONATES	VEHICLE	METHOD OF APPLICATION	COATING DENSITY
T-33C-118	BaSrCa 56/31/13% Amm. carb. ppted. Spherulite Form	Nitrocellulose	Hand Spray	Very high
T-33C-131	BaSrCa 57/39/4% Sodium carb.ppted. Needle Form	Nitrocellulose	Hand Spray	Medium to High
T-33C-132	BaSrCa 57/39/4% Sodium carb. ppted. Needle Form	Nitrocellulose	Hand Spray	Medium
T-33-C-133	BaCO <sub>3</sub> SrCO <sub>3</sub> Single Crystal Sodium carb. ppted. Needle Form	Nitrocellulose	Hand Spray	Very High
T-33C-138	BaSrCa 57/39/4% Sodium carb. ppted. Needle Form	Nitrocellulose	Machine or Hand Spray	Low to Medium
T-33C-144	BaCO <sub>3</sub> SrCO <sub>3</sub> Single Crystal Sodium carb. ppted. Needle Form	Nitrocellulose	Spray	Medium
T-33C-185A	BaSrCa 57/39/4% Sodium carb ppted. Needle Form Low water solubles	Nitrocellulose	Hand Spray	Medium to High
T-33C-304	BaSrCa 57/39/4% Sodium carb. ppted. Needle form	Methyl Methacrylate	Cataphoretic ctg. filamentary wires	High
T-33C-326	BaSrCa 57/39/4% Nickel-carbonyl type Needle Form	Nitrocellulose	Hand Spray	Medium to High
T-33C-326A	BaSrCa 57/39/4% Nickel-carbonyl type Needle Form	Nitrocellulose	Machine or Hand Spray	High
T-33C-334	BaSrCa 56/31/13% Amm. carb. ppted. Spherulite Form	Methyl Methacrylate	Cataphoretic ctg. filamentary wires	High

CATHODE COATING NO.	CARBONATES	VEHICLE	METHOD OF APPLICATION	COATING DENSITY
T-33C-337	BaSrCa 57/39/4% Amm. carb. ppted. Needle Form	Nitrocellulose	Hand Spray	Medium to High
T-33C-338*	BaSrCa 57/39/4% Amm. carb. ppted. Spherulite Form	Butyl Methacrylate	Spray	Medium to High
T-33C-339*	BaSrCO <sub>3</sub> 57/43% Amm. Carb. ppted. Spherulite Form	Butyl Methacrylate	Spray	Medium to High
T-33C-921	BaSrCa 57/39/4% Sodium carb. ppted. Needle Form Low water solubles	Nitrocellulose	Spray	Medium to High
T-33C-340	BaSrCO <sub>3</sub> 57/43% Amm. carb. ppted. Spherulite Form	Nitrocellulose	Spray	Medium

\*(not RCA equivalent)

**TB-164 RCA EQUIVALENT MATERIALS**

**EMISSION CARBONATES POWDER**

Product #	Carbonate	Composition	Form
T-33-B-1A	BaCO <sub>3</sub>	100%	Needle Form
T-33-S-1A	SrCO <sub>3</sub>	100%	Needle Form
T-33-C-42	(BaSrCa)CO <sub>3</sub>	56/31/13%	Spherulite Form
T-33-C-106	(BaSr)CO <sub>3</sub>	57/43%	Needle Form
T-33-C-120	(BaSr)CO <sub>3</sub>	57/43%	Needle Form
T-33-C-125	(BaSr)CO <sub>3</sub>	57/43%	Spherulite Form
T-33-C-130	(BaSrCa)CO <sub>3</sub>	57/39/4%	Needle Form
T-33-C-175A	(BaSrCa)CO <sub>3</sub>	57/39/4%	High Purity
T-33-C-335	(BaSrCa)CO <sub>3</sub>	57/39/4%	Needle Form
T-33-C-813	(BaSrCa)CO <sub>3</sub>	49/44/7%	Spherulite

**PRICE: (per lb.)**

1 lbs.	POR
6 lbs.	POR
26 lbs.	POR

**BINDERS FOR CATHODE COATINGS**

**Nitrocellulose Binders**

T-33-B-10  
T-33-B-109  
T-33-B-110  
T-33-B-114  
T-33-B-608  
T-33-B-902

**Methacrylate Binders**

T-33-B-207  
T-33-B-209  
T-33-B-610F

**PRICE: (per gal.)**

1 gal.	POR
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Production quantities quoted on request.

**HEATER COIL COATINGS**

For Coating Heater Wires in Electron Tubes

ALUNDUM COATING - T-33C-220  
ALUNDUM COATING - T-33C-255L  
HEATER COIL COATING - T-100

**PRICE: POR/gallon**