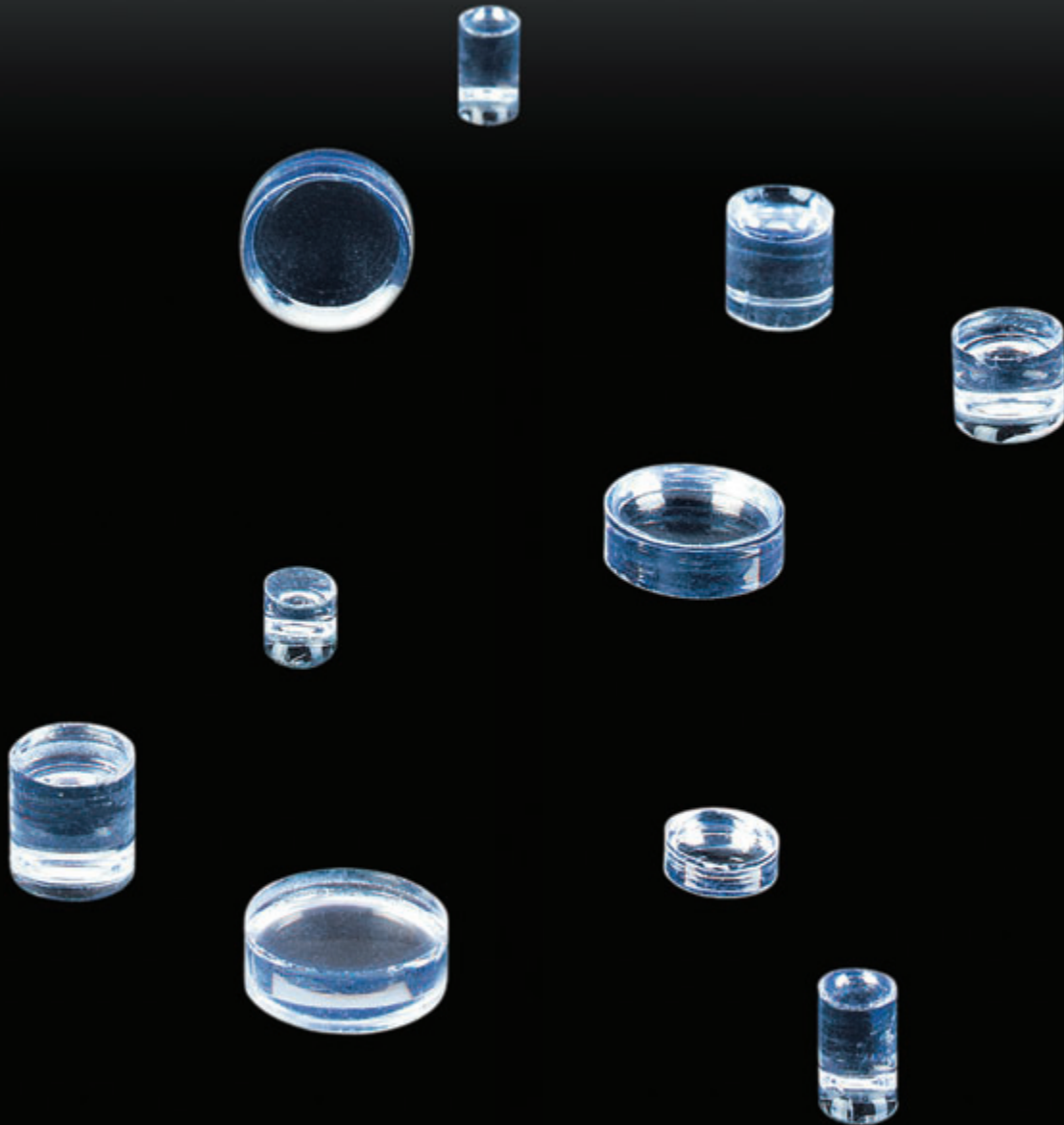


Sources for Research Applications



Alpha Sources—AFR Sources

The AFR sources with rolled foils are available for Am-241 and Po-210. The standard mounting is in a type A-2 capsule (Fig 68-A) with a 9.5 mm (0.375") active diameter.

The active element for Am-241 consists of a rolled monolithic foil in which the activity is incorporated into a thin gold layer and bonded to a 0.001 mm (0.00004") gold cover. (Fig 67-A). The active element for Po-210 consists of a rolled monolithic foil in which the activity is incorporated into a thin gold layer and bonded to a 0.001 mm (0.00004") silver cover. (Fig 67-B). The active foils are sealed into the A-2 capsule with a vacuum compatible epoxy resin. The resulting unit is suitable for space and other high vacuum and low temperature applications. The foil construction is extremely resistant to leakage from puncture since there is no separate window or air space. The self absorption of the gold matrix plus the integral window absorption reduces the alpha-max energy to approximately 4.7 MeV for Am-241 and approximately 4.2 MeV for Po-210. Inquiries for more accurate calibration will be quoted upon request. These sources are not sold as spectral grade sources.

The standard active area is approximately 0.71 cm² corresponding to the 9.5 mm (0.374") window diameter. Contained activity is certified to ±30% of the nominal value. NIST traceability is available for contained activity of Am-241 sources up to 100 μCi (3.7 MBq). NIST traceability is not available for Po-210 sources.

Standard activities are listed below. Higher activities for both nuclides are available on request.

Figure 67-A : Am-241 Rolled Foil Cross-Section

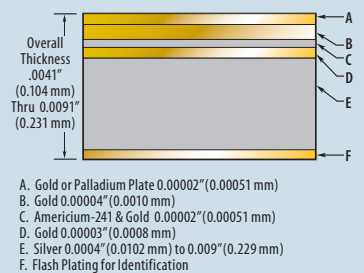
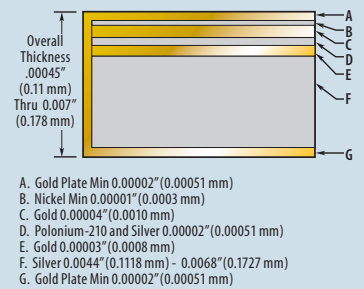


Figure 67-B : Po-210 Rolled Foil Cross-Section



AFR Sources ^(1,2)

Catalog Number	Nuclide	Half-Life	Max Alpha Energy (keV)	Active Diameter	Maximum Activity
AFR-210	Po-210	138.376 days	5304	5 mm	1 μCi
AFR-228	Th-228	698.2 days	5341, 5423	5 mm	1 μCi
AFR-238	Pu-238	87.74 years	5456, 5499	5 - 8 mm	1 μCi
AFR-239	Pu-239	2.411E+04 years	5143, 5156	5 - 8 mm	1 μCi
AFR-241	Am-241	432.14 years	5443, 5486	5 mm	1 μCi
AFR-244	Cm-244	18.11 years	5763, 5805	5 mm	1 μCi

The following group of model numbers is sold as is. Activity and active diameters are not variable, and rolled foils all come with gold cover.

PO2A210U	Po-210	138.376 days	5304	9.5 mm	10 μCi
PO2A2100U	Po-210	138.376 days	5304	9.5 mm	100 μCi
PO2A21000U	Po-210	138.376 days	5304	9.5 mm	1000 μCi
AM1A210U	Am-241	432.14 years	5443, 5486	9.5 mm	10 μCi
AM1A250U	Am-241	432.14 years	5443, 5486	9.5 mm	50 μCi
AM1A2100U	Am-241	432.14 years	5443, 5486	9.5 mm	100 μCi

1) All sources listed are not sold as spectral grade sources.

2) 100 μg/cm² gold covers are available upon request for AFR prefixed models.

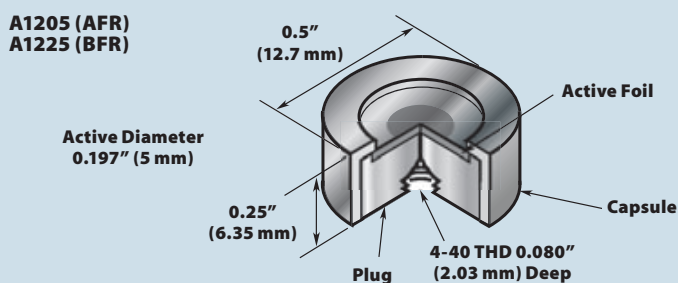
Sources for Research Applications

BFR Sources

These sources provide a safe and convenient package for prototype studies, attenuation, and general laboratory use. The standard mount is in an A-2 capsule. Contained activity is supplied as a nominal value $\pm 15\%$. A NIST traceable calibration of the contained activity is available for Ru-106/Rh-106 only.



Figure 68-A: Type A-2 Capsule



BFR Sources

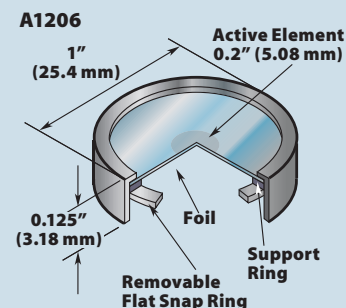
Catalog Number	Nuclide	Half-Life	Principle Beta Emissions (E_{\max} keV)	Substrate	Window	Maximum Activity
BFR-106 ⁽¹⁾	Ru-106 / Rh-106	1.020 y	39 / 3540	0.210" x 0.040" Ceramic	13.7 mg/cm ² Al	10 μ Ci 370 kBq
BFR-090 ⁽¹⁾	Sr-90 / Y-90	28.5 y	546 / 2282	0.210" x 0.040" Ceramic	40 mg/cm ² SS	10 μ Ci 370 kBq
BFR-204 ⁽¹⁾	Tl-204	3.78 y	763	0.210" x 0.040" Ceramic	13.7 mg/cm ² Al	100 μ Ci 3.7 MBq

1) Source has a ceramic active element which will reduce beta output.

Mono-Energetic (Conversion) Electron Sources—ME Series

These sources are used as energy markers for the calibration of solid-state detectors and beta spectrometers. Sources are prepared by electrodeposition or evaporation of the radionuclide as a 0.2" (5.08 mm) diameter spot on very thin Mylar, nickel, or platinum surface foil, and protected by a 100-200 µg/cm² acrylic cover. This assembly is mounted in an aluminum ring from which it can easily be removed (MF-1 mount). Contained activity is supplied as a nominal value ±15%. A NIST traceable calibration of the contained value will be provided on request. Sources are sold as "open sources". The source surface can not be wiped. Please refer to page 72 for complete wipe test information.

Figure 69-A: MF-1 Disk



ME Series								
Catalog Number	Nuclide	Half-Life	Significant Electron Energies (keV)	Substrate	Method of Preparation	Window	Maximum Activity	
ME-133	Ba-133	3862 d	5, 45, 75, 267, 320	Mylar	Evaporation	100-200 µg/cm ² acrylic	10 µCi	370 kBq
ME-207	Bi-207	32.2 y	481, 975, 1047	Platinum	Evaporation	100-200 µg/cm ² acrylic	10 µCi	370 kBq
ME-109	Cd-109	462.6 d	63, 85	Nickel	Evaporation	100-200 µg/cm ² acrylic	10 µCi	370 kBq
ME-137	Cs-137	30.17 y	624, 656	Mylar	Evaporation	100-200 µg/cm ² acrylic	10 µCi	370 kBq
ME-057	Co-57	271.79 d	7, 14, 115, 129	Nickel	Evaporation	100-200 µg/cm ² acrylic	10 µCi	370 kBq
ME-113	Sn-113	115.09 d	20, 23, 364, 388	Platinum	Evaporation	100-200 µg/cm ² acrylic	10 µCi	370 kBq

Sources for Research Applications

Positron Sources—POSK and POSN Series

Ge-68 and Na-22 positron sources are available in titanium and polyimide film configurations. Although designed primarily for use in studies of solid state vacancy phenomena, the titanium configuration may be used in any application requiring conditions of high vacuum or elevated temperature.

The titanium source is 0.750" (19.1 mm) in diameter and has an active diameter of 0.375" (9.53 mm). The activity is placed between two layers of 0.0002" (0.0051 mm) titanium foil, supported by two 0.010" (0.25 mm) titanium disks. This assembly is sealed by electron beam welding.

The polyimide source is 0.5" (12.7 mm) in diameter and has an active diameter of 0.2" (5.08 mm). Other sizes are available upon request. The activity is deposited between two layers of 7.2 mg/cm² polyimide and sealed with epoxy. This source is NOT designed for vacuum applications or for temperatures above approximately 200°C. Contained activity is supplied as a nominal value $\pm 15\%$. A NIST traceable calibration of the contained value will be quoted upon request.

Positron Series

Nuclide	Half-Life	B+ Probability %	Positron (E_{\max} keV)	Major Photons (keV)
Na-22	950.8 d	89.4	2842	511 ⁽¹⁾ , 1275 (100%)
Ge-68 / Ga-68	270.8 d	89	2921 (Ga-68)	511 ⁽¹⁾ , 1077 (3.0%) (Ga-68)

1) From positron annihilation.

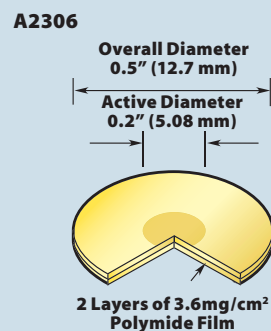
POSK Series

Catalog Number	Nuclide	Support Material	Activity Range	
POSK-22	Na-22	Polyimide	10 μ Ci-100 μ Ci	370 kBq-3.7 MBq
POSK-68	Ge-68	Polyimide	10 μ Ci-100 μ Ci	370 kBq-3.7 MBq

POSN Series

Catalog Number	Nuclide	Support Material	Activity Range	
POSN-22	Na-22	Titanium	10 μ Ci-50 μ Ci	370 kBq-1.85 MBq
POSN-68	Ge-68	Titanium	10 μ Ci-50 μ Ci	370 kBq-1.85 MBq

**Figure 70-A:
POSK Configuration**



**Figure 70-B:
POSN Configuration**

