

Gerda meeting

Geel 11-13/06/2007

Report on ICP-MS measurements
carried out at LNGS
on different GERDA samples

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List of the samples

PLASTIC FOILS

PEN (PolyEthylen-Naphthalate)

KAPTON

MULTI-LAYER SAMPLES

CUFLON 0.010 Inch+ (Teflon covered with Cu)

CUFLON 0.015 Inch+ (Teflon covered with Cu)

CUFLON 0.031 Inch+ (Teflon covered with Cu)

SAMPLE PREPARATION

Multi-layer sample

- 1) weighed by analytical balance;
- 2) cut;
- 3) ultrasound bath (Demi Water)

Plastic Layer

Dry ashing technique:
1) thermal decomposition
PEN → up to **600°C** for 2 h
KAPTON → up to **850°C** for ~ 2 h
TEFLON → up to **600°C** for ~ 2 h
2) residual ash leached
in HNO_3 20% at 85°C for 1 h

metallic layer

Metals are placed in solution by acid digestion:
 $\text{Cu} \rightarrow \text{HNO}_3$ (UltraPure, 30%)



Results from ICP-MS analysis

1) Without taking into account the mass factor:

		K [ppb]	Pb [ppb]	Th [ppt]	U [ppt]
KAPTON (from M.L. roll)		240 ± 80	90 ± 10	160 ± 20	1380 ± 140
CUFLON 0.010	Teflon	<200	<1000	22 ± 4	18 ± 2
	Cu	<2000	150 ± 50	90 ± 30	90 ± 30
CUFLON 0.015	Teflon	300 ± 100	200 ± 60	<25	<25
	Cu	<2000	100 ± 30	170 ± 20	70 ± 7
CUFLON 0.031	Teflon	<200	<1000	<25	<18
	Cu	<3000	180 ± 50	150 ± 50	170 ± 50

2) taking into account the mass factor:

		Mass fraction	K [ppb]	Pb [ppb]	Th [ppt]	U [ppt]
CUFLON 0.010"	TEFLON	0.59	<120	<600	13 ± 2	11 ± 1
	Cu	0.41	<820	60 ± 20	40 ± 10	40 ± 10
	Whole sample		< 940	60 ₋₂₀ ⁺²⁰⁰	50 ± 10	50 ± 10
CUFLON 0.015"	TEFLON	0.59	180 ± 60	120 ± 40	<15	<15
	Cu	0.41	<820	40 ± 10	70 ± 8	29 ± 3
	Whole sample		180 ₋₆₀ ⁺³⁰⁰	160 ± 40	70 ₋₈ ⁺⁹	29 ₋₃ ⁺⁶
CUFLON 0.031"	TEFLON	0.79	<160	<790	<20	<14
	Cu	0.21	<630	40 ± 10	30 ± 10	40 ± 10
	Whole sample		<790	40 ₋₁₀ ⁺²⁶⁰	30 ₋₁₀ ⁺¹²	40 ₋₁₀ ⁺¹¹

Activities for ^{40}K , ^{232}Th , ^{238}U by ICP-MS

Sample	^{40}K	^{232}Th	^{238}U
	[mBq/kg]	[mBq/kg]	[mBq/kg]
Samples of January 2007			
1 KAPTON (from Bela)	9 ± 2	0.6 ± 0.2	12 ± 4
2 KAPTON (from Bela) with Cu	< 22	$0.73_{-0.08}^{+0.12}$	$2.9_{-0.3}^{+0.4}$
3 KAPTON (from Bela) with Cu+Ni	< 25	0.4 - 0.6	12 ± 1
4 KAPTON (from Bela) with Cu+Ni+Au	< 27	0.7 ± 0.1	2 - 3
5 PEN (big roll found contaminated by γ -spec)	370 ± 50	110 ± 10	200 ± 30
New samples May 2007			
KAPTON (from Matthias L. roll)	7 ± 3	0.65 ± 0.08	17 ± 2
CUFLON 0.010 Inch	<30	0.20 ± 0.04	0.62 ± 0.12
CUFLON 0.015 Inch	5_{-2}^{+9}	$0.28_{-0.03}^{+0.04}$	$0.36_{-0.04}^{+0.07}$
CUFLON 0.031 Inch	<25	$0.12_{-0.04}^{+0.05}$	$0.50_{-0.12}^{+0.14}$

Comparison between γ -spectroscopy and ICP-MS measurements

		^{40}K [mBq/kg]	^{232}Th [mBq/kg]	^{238}U [mBq/kg]
NAC-2	γ -spectroscopy	81 ± 19	5.0 ± 2.0	22 ± 2
	ICP-MS	86 ± 5	7.2 ± 0.3	23.6 ± 0.9
PEN (from M.L.big roll)	γ -spectroscopy	510 ± 20	135 ± 3	242 ± 3
	ICP-MS	370 ± 50	110 ± 10	200 ± 30
KAPTON (from M.L. roll)	γ -spectroscopy	<5.4	1.4 ± 0.7	14 ± 1
	ICP-MS	7 ± 3	0.65 ± 0.08	17 ± 2

The 2 techniques are complementary and in this case the results are in good enough agreement