

SRD1000 superconductive reference device evaluation and improvements

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Introduction

- SRD1000 supports 10 reference temperatures on the PLTS-2000 ¹
- Device detects the superconductive transitions of various samples ²
- Prototype series was evaluated ³
- Improved reference samples are produced for a new series.

Transition temperatures T_C and widths W_C of SRD1000 prototypes and a new series devices

#	reference material	nominal T_C [mK]	W_C prototypes [mK]	W_C new series [mK]
1	W	15	< 0.2	< 0.2
2	Be	22	< 0.3	< 0.3
3	Ir ₉₀ Rh ₁₀	30	0.7 - 1.2	0.3 - 1
4	Ir ₉₂ Rh ₈	65	0.7 - 1	0.3 - 1
5	Ir	98	0.3 - 1	0.3 - 1
6	AuAl ₂	145	0.4 - 0.7	0.3 - 0.6
7	AuIn ₂	208	0.5 - 3	0.5 - 1
8	Cd	520	12 - 15	2 - 4
9	Zn	850	5 - 16	2 - 3
10	Al	1180	2 - 4	2 - 4

- In the new series W_C 's of Cd and Zn transitions are up to 4 x smaller

Possible future developments

- Additional reference points: 350 mK (Ti), 920 mK (Mo)
- Inclusion of CMN thermometer

Conclusion

- Evaluation of prototypes shows that the SRD1000 is a convenient and reliable instrument for calibrations on the PLTS-2000
- Improved preparation methods reduce W_C of the Cd and Zn transitions by a factor of 4 compared to prototypes
- A new series devices will contain improved Cd and Zn samples, enabling more accurate determination of T_C 's

References

1. R. Rusby et al., *J. Low Temp. Phys.* **126**, 633 (2002).
2. W. Bosch et al., in *Temperature: Its Measurement and Control in Science and Industry* **7**, 155-160 (2003), edited by D.C. Ripple, AIP, New York.
3. A. Peruzzi et al., *Proc. of TEMPMEKO2004*, Dubrovnik, Croatia; also S. Schöttle et al., *Proc. of QFS2004*, Trento, Italy.

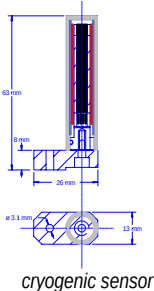
Financial support

European Commission, Measurement and Testing activity of the Competitive and Sustainable Growth programme, contract number G6RD-CT-1999-00119

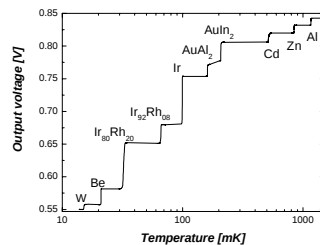
Further information

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Web page: <http://www.xs4all.nl/~hdleiden/srd1000>



cryogenic sensor



output electronics versus temperature

Evaluation of SRD1000 prototypes

- European institutes for metrology evaluated prototype devices and measurement electronics ³
- SRD1000 proves to be reliable for transferring the scale
- Widths of the Cd and Zn transitions significantly contribute to the uncertainty of determining the reference temperatures

Preparation of Cd and Zn samples for a new series

- Samples were spark cut from high purity single crystals
- Copper-sulphate etch removes the interaction area cutting process
- Omitting varnish from attachment process reduces mechanical stress

Transitions Cd and Zn of prototype samples compared to new series

