SRD1000: A SUPERCONDUCTIVE REFERENCE DEVICE FOR THERMOMETRY BELOW 1K

25EP3

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Introduction A Superconductive Reference Device (SRD1000), including 10 reference points in the temperature range 10 mK – 1 K, has been developed to provide a direct and accurate traceability to the PLTS-2000, the new Provisional Low Temperature Scale. Currently 5 SRD1000 prototypes are being constructed, calibrated and distributed to European metrological institutes and industrial partners. They will evaluate the series to determine its suitability as transfer standard for the PLTS-2000.

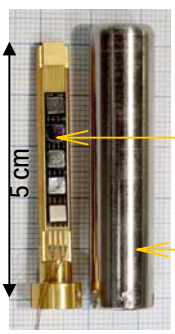
Project partners for the development

HDL development of sensors and measurement electronics
LION preparation, analysis and testing of bulk sample materials
NMi calibration of the SRD1000
UT development of thin film materials and sensors

SRD1000 reference temperatures and sample materials

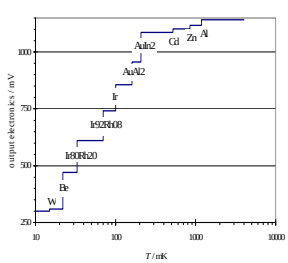
1)	15 mK	W	single crystal, Al spot weld
2)	20	Be	2N8 foil, Al spot weld
3)	35	$Ir_{80}Rh_{20}$	melt 4N5 Ir, 4N8 Rh powder
4)	70	$Ir_{92}Rh_{08}$	melt 4N5 Ir, 4N8 Rh powder
5)	100	Ir	melt 4N5 Ir powder
6)	160	$AuAl_2$	melt 5N4 Au powder, 5N Al powder
7)	208	$AuIn_2$	melt 5N4 Au powder, 6N In powder
8)	520	Cd	melt 6N shot
9)	850	Zn	melt 6N shot
10)	1180	Al	5N5 foil

SRD1000 sensor and electronics

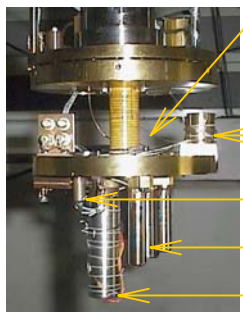


The SRD1000 sensor includes 10 sample materials. They are attached to a planar mutual inductance system for detecting the superconducting transitions.

A magnetic shield (Cryoperm and niobium) reduces ambient magnetic fields by a factor of 500 or more.



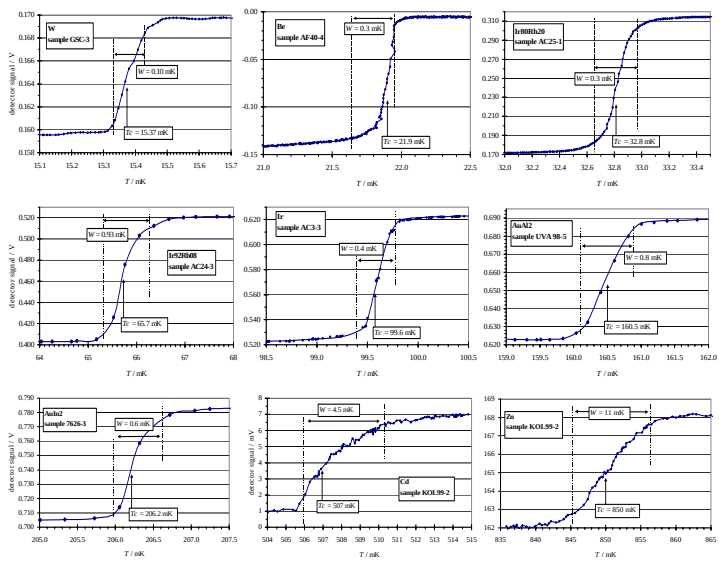
SRD1000 calibration facility



A thermal plate is attached to the mixing chamber of the NMi dilution refrigerator. Calibration on the PLTS-2000 is performed using:

- a ^{3}He melting pressure thermometer
- several RhFe, Speer carbon and RuO_2 resistance thermometers
- up to 3 SRD1000 sensors
- SRM 767 and SRM768 reference devices.

Typical transitions observed for the SRD1000 prototypes



For each sample material the transition temperature T_c and width W are indicated. Characteristics of sensor and electronics allow a determination of the T_c of better than 0.1 % of a reference temperature.

Further developments Commercial production of devices and electronics will start in 2003 after the evaluation of the prototypes. The inclusion of a magnetic thermometer (CMN) will be considered.

SRD1000 web site www.xs4all.nl/~hdleiden/srd1000

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