Table A.5.2:Repeatability test results

Source	Sample ID	Reported RRR	Test 1	Test 2	Rept. %
FNAL	Dec07/04	364	367.7	366.7	0.27
FNAL	Dec07/05	325	315.2	322.2	2.22
CERN	CERN/05	162	160	164.1	2.56
CERN	CERN/13	146	143	144.5	1.05
NFC	Nb/IC1/01	---	24.23	24.36	0.54
NFC	Nb/IC4/01	---	48.63	49.19	1.15
RRCAT	Nb/IMP	---	403	396.3	1.66

In conclusion, a facility for measuring the RRR of superconducting Nb has been set up. The results obtained from this apparatus are comparable within ± 5% of the reported values on known samples. The system repeatability is within 3% of the measured value of RRR. The measurement facility is operational and is being routinely used.

Reported by:
A.Yadav (anandyadav@rrcat.gov.in),
M.A.Manekar and A. Puntambekar

A.6: Development of high reflectance Mo/Si soft x-ray multilayer mirror for normal incidence applications.

X-ray multilayer (ML) is a periodic arrangement of alternating layers of high-Z and low-Z elements. Mo/Si ML is one of the efficient mirror in the soft x-ray region at wavelengths above the Si L-edge (124 Å) due to high reflectivity. The surface and interfaces of Mo/Si have been studied extensively due to technological application such as lithography, astronomy, x-ray microscopy and spectroscopy. X-ray Optics Section of RRCAT has been fabricating high reflectance Mo/Si multilayers for developing Schwarzschild microscope for soft x-ray reflectivity / fluorescence beam-line on Indus-2 Synchrotron Radiation (SR) Source and polarimeter for soft x-ray polarization measurements on Indus-1 / Indus-2.

Mo/Si MLs were fabricated on Si wafer (roughness ~4 Å) using custom designed DC / RF magnetron sputtering system. The sputtering system has two rectangular cathodes of 500 mm length and 100 mm width. The sputtering was done using argon ion at a pressure of $3x10^{-3}$ mbar. The base vacuum in the chamber was ~2 10^{-8} mbar before starting the process. Substrates were cleaned using ion etching gun mounted in the load lock chamber. The deposition rate for Mo was ~4 Å/sec and for Si 0.3 Å/sec. Soft x-ray measurements were carried out on reflectometry beam-line at Indus-1 synchrotron radiation source. The beam-line provides monochromatic photons in the wavelength range of 10-300 eV, using a toroidal grating monochromator with a resolving power of 200-500.

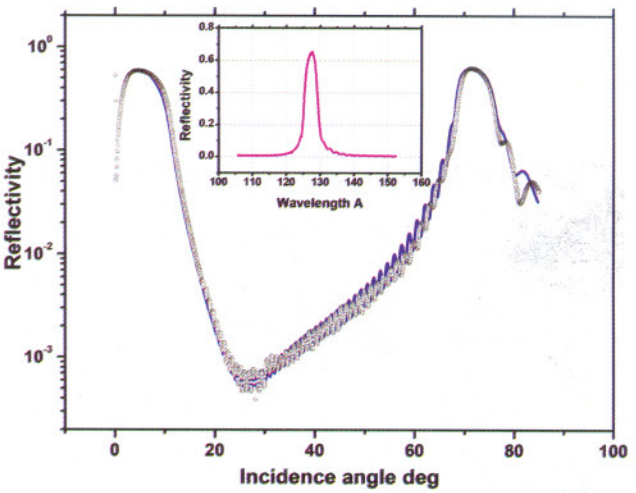

Fig. A.6.1: High reflactance multilayer mirror developed for normal incidence soft x-ray application with d=69Å, N=65 layer pairs, shows a 63% reflectivity. Continous line represents fitted curve and open circles are measured data points. In inset wavelength versus reflectivity curve measured at 72.5° deg incidence angle is shown.

Figure A.6.1 shows angle versus reflectivity scan of Mo/Si ML with d=69 Å and N=65 layer pairs at a wavelength of 127 Å. The multilayer gives 63% reflectivity at an incidence angle of 71°. The wavelength versus reflectivity scan, shown in the inset, was measured at a Bragg angle of 72.5°. Due to accurate control over individual layer thicknesses in the multilayer stacks, all the secondary oscillation fringes are measured. The multilayer with suitable varying periodicity will be used for potential application in the wavelength range of 126 -150 Å. The reflectivity performance achieved is in good agreement with the experimental values reported by different laboratories across the world.

Reported by
G.S. Lodha (lodha@rrcat.gov.in).