INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MATERIALS MANAGEMENT DIVISION
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Specifications for the Single Resonance Nuclear Magnetic Resonance (NMR) Spectrometer without a Magnet.
RFx No. 6100000889 (Reference No. 1000016790)

The NMR spectrometer detailed below will be used together with cryofree, sweepable 9 Tesla superconducting magnet + variable temperature insertVTI to perform NMR experiments on solid samples at variable temperature and magnetic field.

The NMR spectrometer is to be used for measurements on solid samples and should include the following:

1. A (frequency synthesizer) transmitter with a frequency range of at least 5 MHz - 300 MHz with 1 Hz (or better) frequency resolution. Less than 50 ns rise time for the rf pulses. With a nominal output of 1 V, the pulse amplitude should be controllable in a range greater than or equal to0-90 dB. The phase should be adjustable with a resolution of1 degree or less. High stability oven oscillator with greater than 1×10^{-9}/day stability.
2. A 500 W (or greater) linear rf power amplifier with a minimum frequency range of 5 MHz-300 MHz and a blanking delay of 1 μsec or less and a maximum pulse width of at least 20 msec.
3. Preamplifier with a minimum frequency range 5 MHz-400 MHz, low-noise (1.1-2.3 dB noise figure) and fast recovery (less than 1 μsec recovery time). The preamplifier gain should be more than 25 dB.
4. Wideband digital rf receiver with digital quadrature detection. The receiver bandwidth should be greater than 12MHz. The dead-time of the receiver should be less than 1 μsec. The receiver should have a gain of more than 80 dB (without preamplifier). A digitization rate of better than one point every 100 ns should be possible in the complex data.
5. Digital pulse programmer with which user-defined pulse sequences can be generated. Minimum pulse width of 10 ns and timing resolution of 10 ns. Minimum duration of an event 100 ns. The phase and amplitude of the pulses and the various delays should be programmable.
6. Transcouplersfor the 5-200 MHz frequency range with > 2 kW power handling capabilities, low insertion loss, broadband-T.
7. A series of ¼ wavelength cables or plug-ins to cover the 5 to 200 MHz range should be provided. Also, provide swept frequency probe tuning.
8. One Signal Averager with at least 1GB of memory (e.g. 512 x 512 x 512).
9. Fast (greater than 480 Mbits/s) USB 2.0 interface to pulse programmer and signal average

10. Software for NMR data acquisition and analysis. All time domain data must be stored on the hard disc and should be retrievable later for analysis. Standard sequences for T_1 and T_2 measurements should be available. In the sequences, phase and amplitude of the individual pulses should be adjustable. The position of the trigger signal for the signal averager to record data should be adjustable. The number of signal averages that the software and hardware allows should be more than 100000. In a pulse sequence, the minimum pulse width possible should be less than 1 μsec. It should be possible to repeat a pulse sequence from a rate of once every 1 msec to once every 10 minutes.
11. The NMR spectrometer will be used together with a cryofreefield sweep 9 Tesla superconducting magnet with a variable temperature insert (VTI) and a standard PID temperature controller(0.1 K accuracy) enabling one to do automated measurements as a function of magnetic field and temperature.The magnet is C-Mag Vari-9-10P from Cryomagnetics USA. The magnet power supply is Model 4G-100 from Cryomagmetics USA. The temperature controller is a Cryocon model 24 C. Please build in the necessary protocols in the NMR system software to control the temperature controller and the magnet power supply and do automated NMR measurements as a function of magnetic field and temperature.
12. Single resonance, variable temperature (1.5 K to 300 K) probe-heads to cover the range 5 MHz to 200 MHz. A goniometer with a resolution of 1 degree should be built-in and mechanically adjustable from the top. A cernox temperature sensor should be located near the sample coil. The probehead assembly should be compatible with the NMR spectrometer and the VTI. In particular, the ID of the VTI cryostat will be a nominal 49 mm with a KF50 flange at the top. The probe will have to be designed such that the sample coil is at the center of the superconducting solenoid magnet as per the design of the magnet and VTI. We will provide the precise dimensions to the successful bidder. Cable for connecting the cernox sensor (from the top flange of the probehead) to the temperature controller (Cryocon model 24 C has DIN-6 receptacles on the rear panel) is to be provided by you.
13. RF Line Section with RF Extractor directional coupler for high power tuning. Give the model/make and specifications.
14. Digital storage oscilloscope (dual channel or more with bandwidth of 300 MHz or more and with option of 50 ohm input impedance) to monitor forward and reflected power taken from the line extractor. Give the model/make and the specifications.
15. An electronics rack (made of non-magnetic materials) to house various unitssuch as pulse amplifier, temperature controller, NMR pulse programmer, etc.
16. All equipment should be compatible with single phase 220 V, 50 Hz ac power supply.

Terms and conditions
1. The vendor should have a proven track record in terms of prior installations and technical support in India. (Please furnish the contact details of the customers).
2. Include comprehensive warranty of 3 years from the date of installation.