



INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MATERIALS MANAGEMENT DIVISION
Powai, Mumbai 40076

Technical specifications for a Quadrupole Mass Spectrometer to sample gases during high pressure pyrolysis :

The vendor is expected to provide a mass spectrometer capable of sampling gases during pyrolysis with the following technical specifications –

1. Inlet to the mass spectrometer:

- a. The inlet to the mass spectrometer should allow sampling of gases from the pyrolyzer.
- b. The inlet should consist of a heated tube with a minimum length of 4 inches to avoid condensation of gases.
- c. The temperatures should be user-controllable between 200 to 400 C.
- d. The inlet should function under an operating atmosphere with pressures up to 100 bar.
- e. At least two inlet apertures should be provided. The design should be optimized to prevent further reactions or decomposition.

2. Stages of the mass spectrometer:

- a. The vendor should ensure that the system has at least three stages.
- b. The first stage should be supplied with a first stage that can be easily segregated from the rest of the stages using preferably a gate valve, thus facilitating fast cleanup of the first aperture.

- c. The first aperture should be heated.
 - d. The first stage should be maintained at a pressure <2 torr using suitable pumping systems.
 - e. The second stage should be maintained at a pressure $<10^{-3}$ torr using suitable pumping systems.
 - f. The third stage should be maintained at a pressure $<10^{-5}$ torr using suitable pumping systems.
3. Detector and associated instrumentation:
- a. The system should contain
 - i. An electron impact ionizer,
 - ii. Tri-filter quadrupole mass filter, and
 - iii. Electron multiplier detector, with conversion dynode to eliminate mass discrimination and improve overall sensitivity.
 - b. The masses detected should be from 1 to 500 amu.
 - c. The resolution should be $> 1800 (M/\Delta M)$.
 - d. The relative transmission should be $> 50\%$.
 - e. The general sensitivity should be ≥ 2 mA/torr.
 - f. Quadrupole tri-filter with 19 mm rod diameter or higher.
 - g. The data acquisition rate should be < 100 microseconds per point during scanning spectra.
 - h. The precision of the system should be $< \pm 30$ ppm absolute on a 1% argon sample.
 - i. The stability of the system should be ± 0.01 amu.
 - j. External Scan trigger.

- k. Ion deflector between ionizer and quadrupole to bend ions off-axis by 90 degree or similar, separating ions from photons, meta-stables, particulates and molecular beam gases. This improves signal to noise of the mass spectrometer system.
- l. Lab View integration available.
- m. Negative and positive ion detection.
- n. Analog and digital I/O.
- o. Mass programmable quadrupole entrance lens and quadrupole pole bias to improve ion transmission across the whole mass range, especially the ion transmission at the very low end and high end of the mass range
- p. User programmable macros available to customize data acquisition and post-acquisition data processing.
- q. Vacuum Interlock to protect the instrument in case of power outage and vacuum loss.
- r. Ion gauge connection to read vacuum pressure from control software.