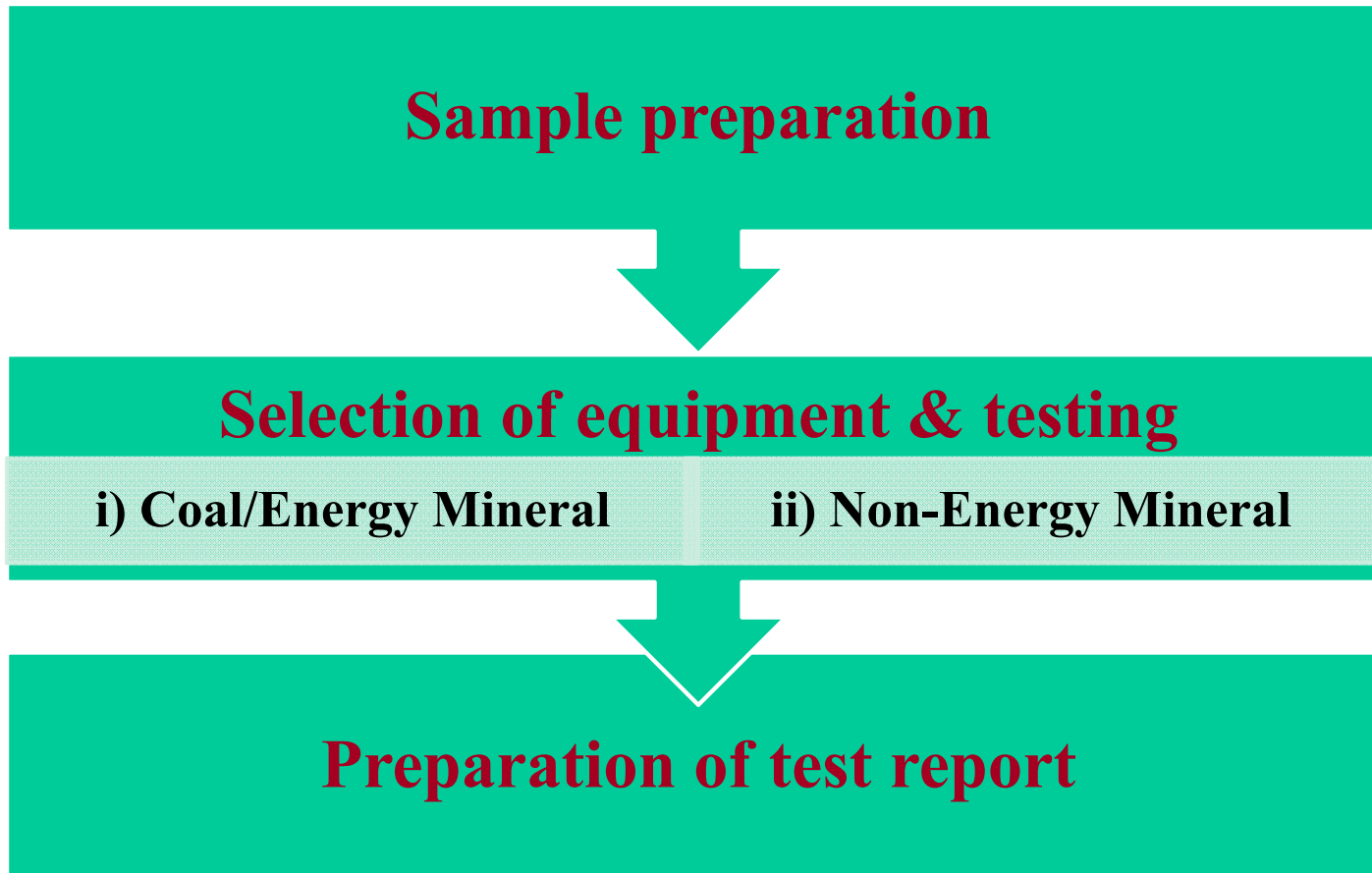




MECL

Facilitator
Rohit Sharma
Asst. Manager (Chem.)

CHEMICAL ANALYSIS & PARAMETER FOR GRADE ASSESSMENT



Sample Preparation

1. Sample preparation is the key to accurate & precise chemical analysis
2. Sample should be homogeneous & representative
3. Sample should be in compliance with particle size as specified in relevant testing procedure
4. A typical sample preparation setup includes following equipment-



Hydraulic core splitter



Jaw crusher



Vibratory cup mill



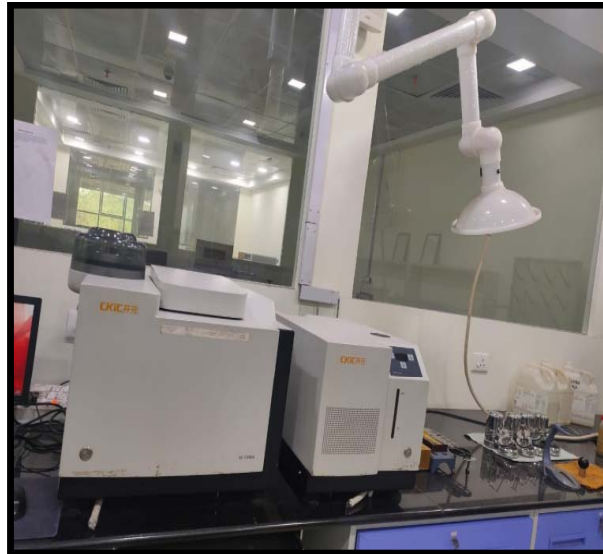
Sieve shaker

Coal /Energy Minerals

- 1. BAND BY BAND ANALYSIS**
- 2. PROXIMATE ANALYSIS**
- 3. EQUILIBRATED MOISTURE TESTING**
- 4. GROSS CALORIFIC VALUE (GCV) TESTING**
- 5. TOTAL SULFUR & SULPHUR DISTRIBUTION**
- 6. ULTIMATE ANALYSIS**
- 7. ASH FUSION TEMPERATURE (AFT)**
- 8. ASH ANALYSIS**
- 9. CRUCIBLE SWELLING INDEX/NUMBER**
- 10. HARD GROVE GRINDABILITY TEST (HGI)**



CHN & CHNS Analyzers



Automatic Bomb Calorimeters



Proximate Analyzers



Hard-grove Grindability Index Tester



Crucible Swelling Index Tester



Ash Fusion Tester

Classification of Coal by Rank

Class	% FC	Gross Caloric Value (Kcals./kg)	% C	% H	% O
Anthracite	86 - 98	7000-9000	90 – 97	3 – 5	1 – 3
Bituminous	68 – 86	4000-7000	85 – 90	4 - 5	5 – 10
Sub-Bituminous	30 - 68	3000 - 4000	75 – 85	5	10 – 20
Lignite	25 - 30	2000 – 3000	70 - 75	4 – 5	20 – 25
Peat	< 20	1500 – 2000	50 – 60	5 – 6	35 - 40

GCV Based Grading of Coal

Grade of Coal	GCV (Kcal/kg)
G1	Above 7000
G2	6701 to 7000
G3	6401 to 6700
G4	6101 to 6400
G5	5801 to 6100
G6	5501 to 5800
G7	5201 to 5500
G8	4901 to 5200
G9	4601 to 4900
G10	4301 to 4600
G11	4001 to 4300
G12	3701 to 4000
G13	3401 to 3700
G14	3101 to 3400
G15	2801 to 3100
G16	2501 to 2800
G17	2201 to 2500

Non-Coal /Non-Energy Minerals

- ▶ **IRON ORE**
- ▶ **BAUXITE**
- ▶ **COPPER**
- ▶ **CROMITE ORE**
- ▶ **LEAD**
- ▶ **ZINC**
- ▶ **LIME STONE**
- ▶ **PHOSPHORUS**
- ▶ **MANGANESE**
- ▶ **GOLD**
- ▶ **SILVER**
- ▶ **Etc ..**

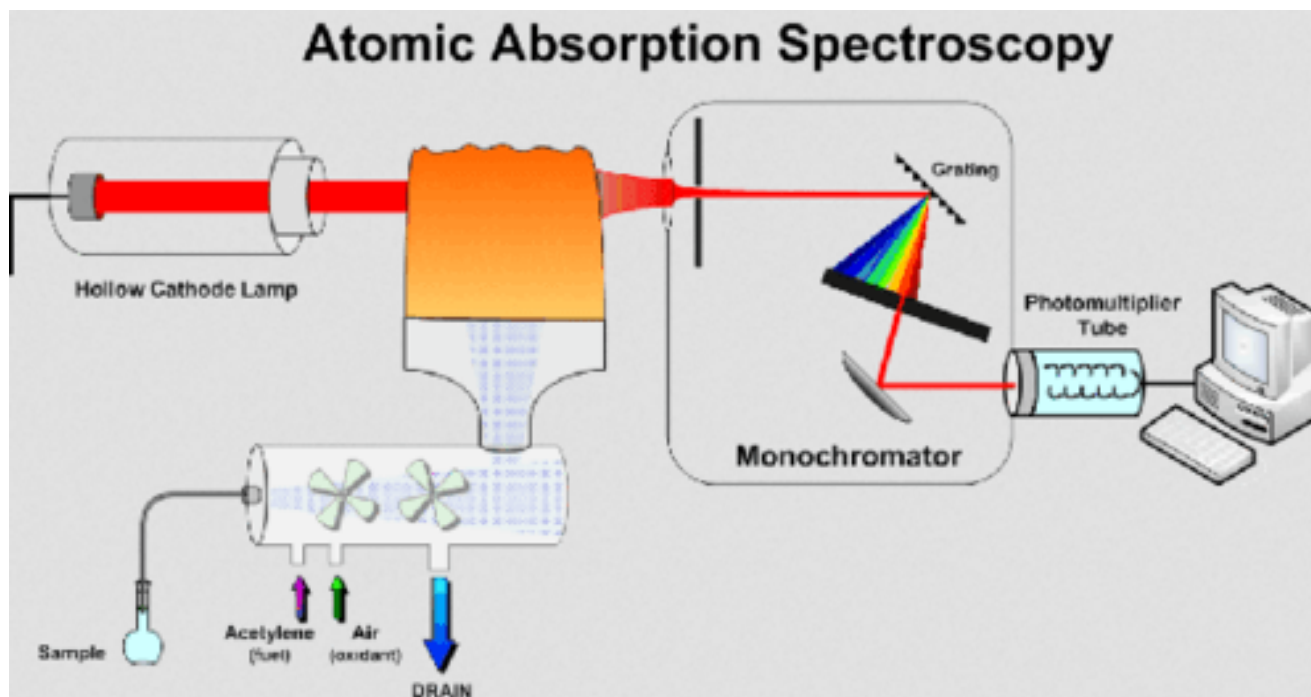
1. **Proper sample digestion is required**
2. **Water to be used should be ultra-pure grade**
3. **Lab atmosphere should be contamination free**
4. **A typical wet classical lab is shown in figure below-**



Atomic Absorption Spectrometer

This equipment shown in figure is AnalytikJena, Germany make Atomic Absorption Spectrometer. In addition to flame, it is also equipped with graphite furnace atomizer. It is used for Na, K, Ca, Mg, Cr, Mn, Fe, Cu, Zn, Pb, Al, P, W, Ti, Co, Ni, Ag, Ba, Li, Cs, Sr, Cd element determination in mineral samples.

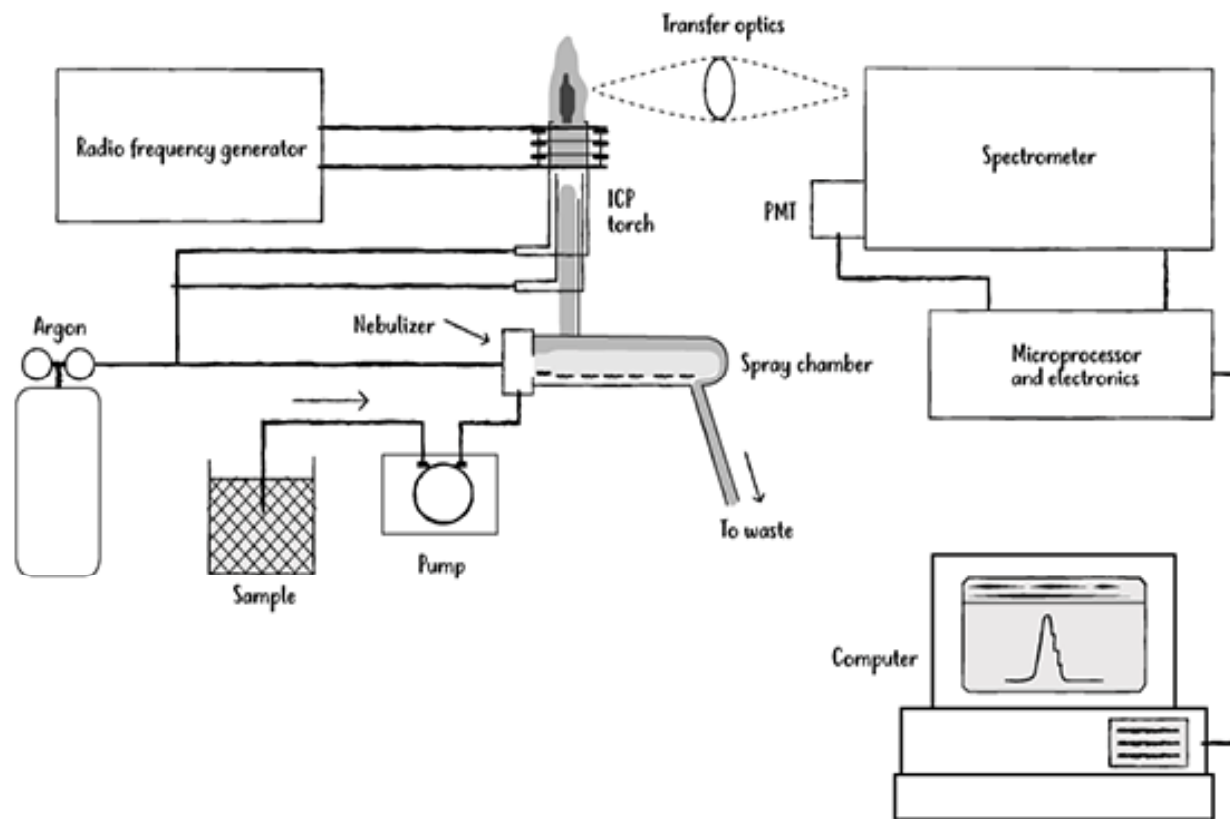




Inductively Coupled Plasma Optical Emission Spectrometer

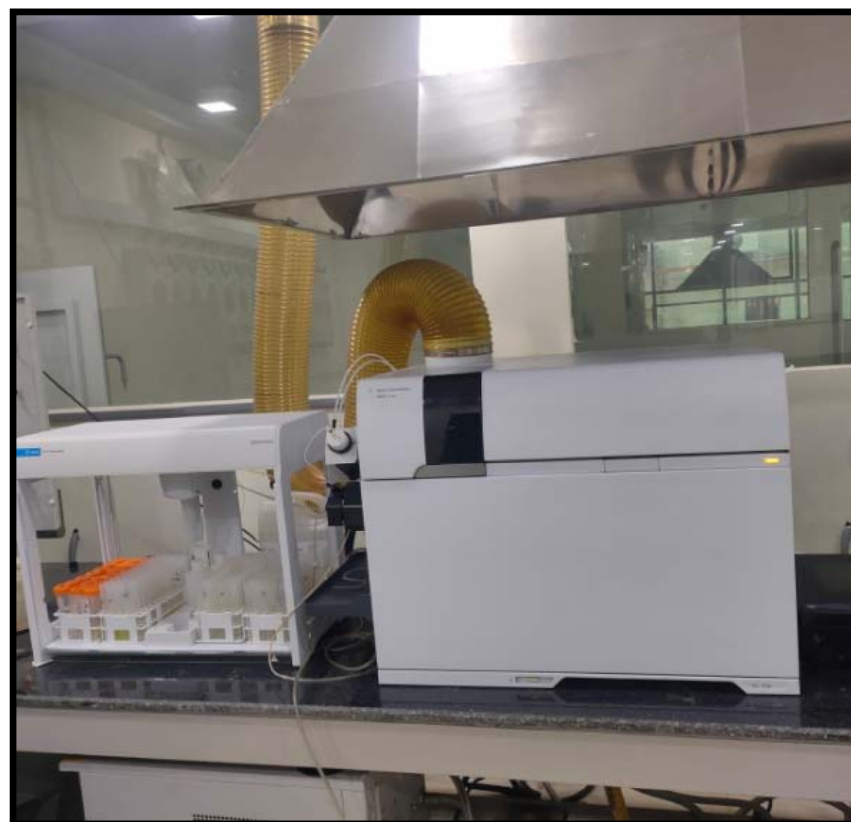
This equipment shown is Thermo-fisher, USA make Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) which is capable to determine major, minor and trace elements (different concentrations) in one single run measurement. This instrument can determine - Al, Sb, As, Ba, Be, Bi, B, Cd, Ca, Ce, Cs, Cr, Co, Cu, Dy, Er, Eu, Gd, Ga, Ge, Au, Hf, Ho, In, Ir, Fe, La, Pb, Li, Lu, Mg, Mn, Hg, Mo, Nd, Ni, Nb, Os, Pd, P, Pt, K, Pr, Re, Rh, Rb, Ru, Sm, Sc, Se, Si, Ag, Na, Sr, S, Ta, Te, Tb, Th, Tl, Tm, Sn, Ti, W, U, V, Yb, Y, Zn, Zr elements in mineral samples.

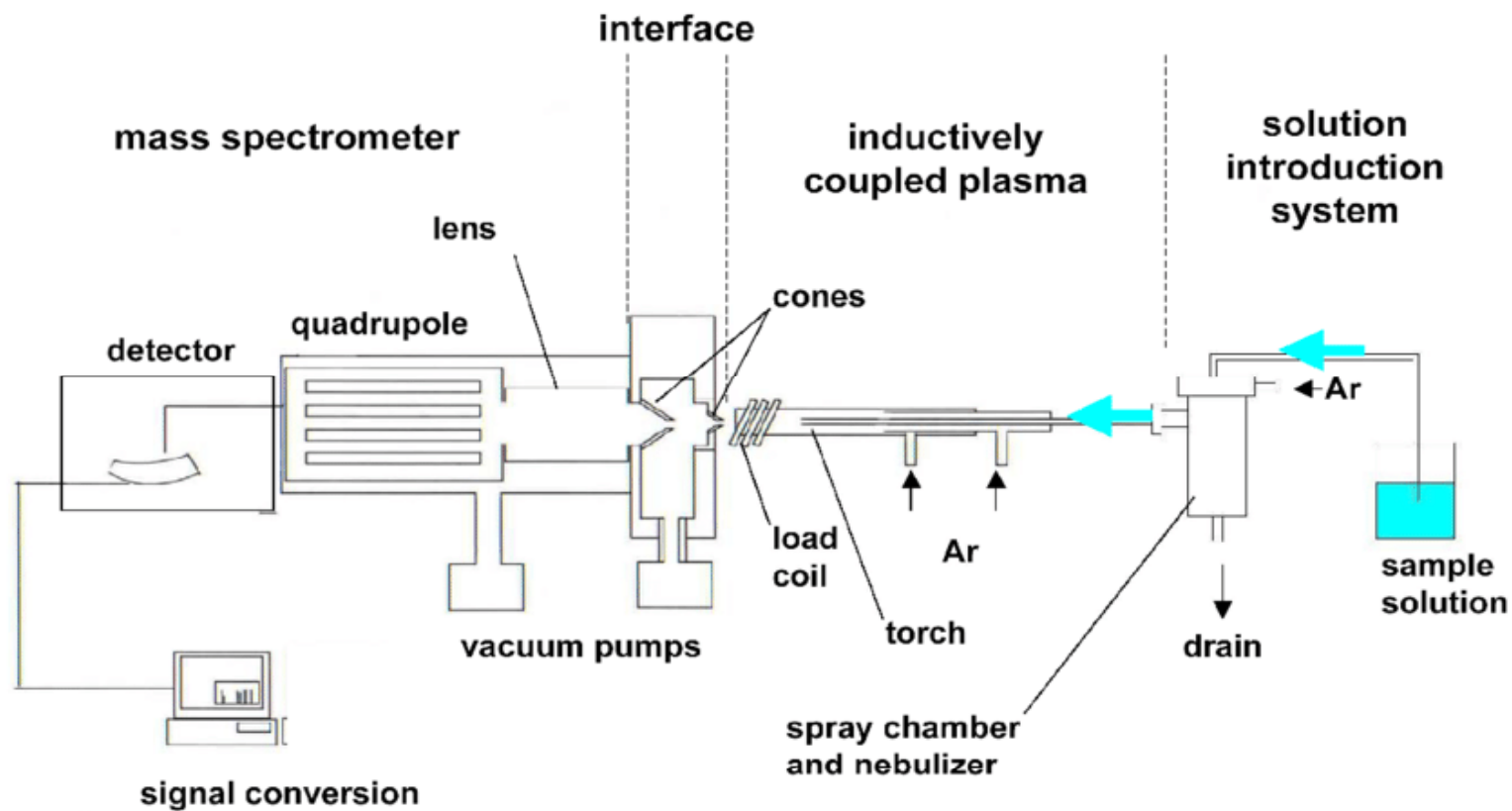




Inductively Coupled Plasma-Mass Spectrometer

The equipment shown is a Quadrupole ICP-MS system which is capable of doing elemental analysis accurately & precisely for REE and PGE and trace elements in higher concentration, trace and ultra-trace (ppm, ppb & ppt) levels in diverse range of matrices. It is used to determine Al, Sb, As, Ba, Be, Bi, B, Cd, Ca, Ce, Cs, Cr, Co, Cu, Dy, Er, Eu, Gd, Ga, Ge, Au, Hf, Ho, In, Ir, Fe, La, Pb, Li, Lu, Mg, Mn, Hg, Mo, Nd, Ni, Nb, Os, Pd, P, Pt, K, Pr, Re, Rh, Rb, Ru, Sm, Sc, Se, Si, Ag, Na, Sr, S, Ta, Te, Tb, Th, Tl, Tm, Sn, Ti, W, U, V, Yb, Y, Zn, Zr elements up to ultra-trace levels.



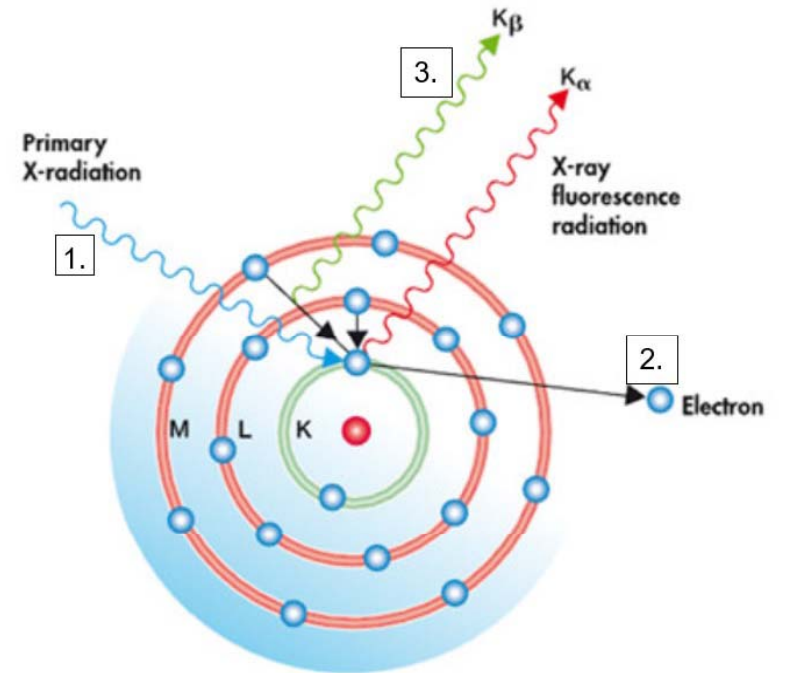
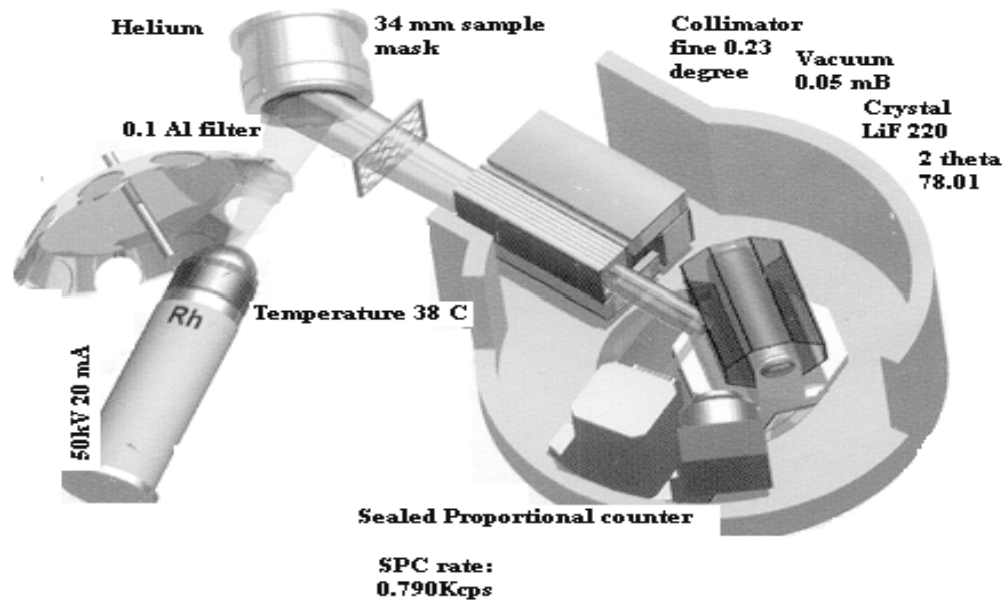


Wavelength Dispersive X-ray Fluorescence spectrometer

The WD-XRF system, capable of analysing major, minor and trace elements in rocks/ores/minerals and geological materials as solid samples (pressed pellets and fusion beads). It is used for all the major oxide radicals in mineral samples.



Typical view of the WDXRF Spectrometer

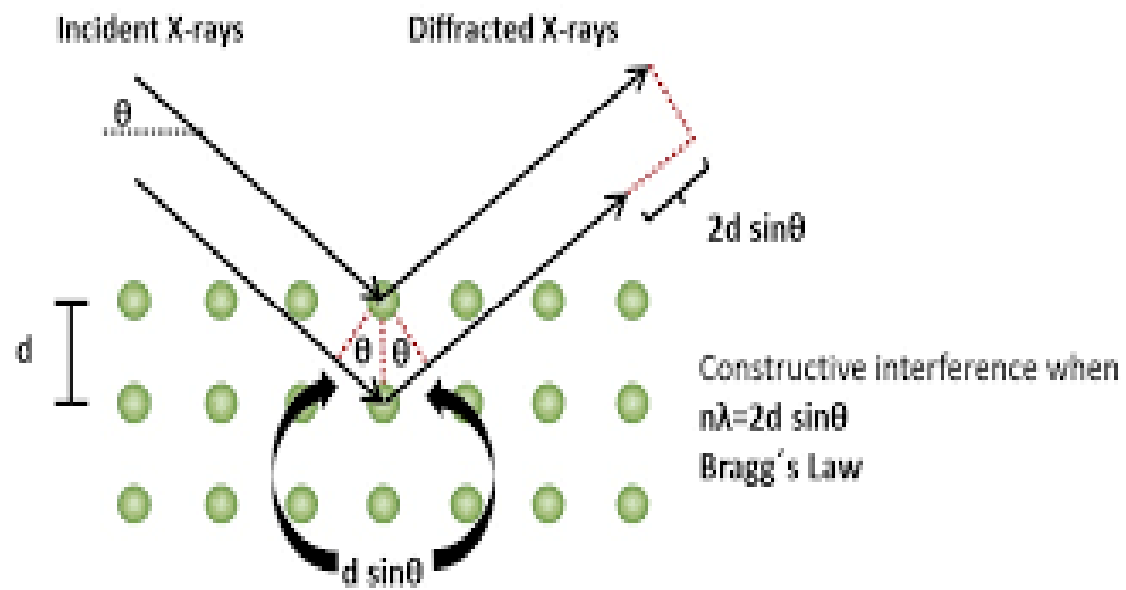


XRD

X-ray Diffractometer

Panalytical, UK make X-ray Diffractometer (XRD). This is used for phase analysis in mineral samples.





FIRE ASSAY METHOD

Fire Assay setup

Full setup of Fire Assaying, capable of fire assaying of Gold, silver, PGE and other mineral ore samples using "Lead fire assay" and "Nickel sulphide fire assay" methods. The setup is equipped with multi-load and multi-pour accessories to facilitate the loading of all the crucible and couples in batches and also the unloading & pouring in batches for faster assaying.



FIRE ASSAY METHOD



Fire assay crucible having charge and sample



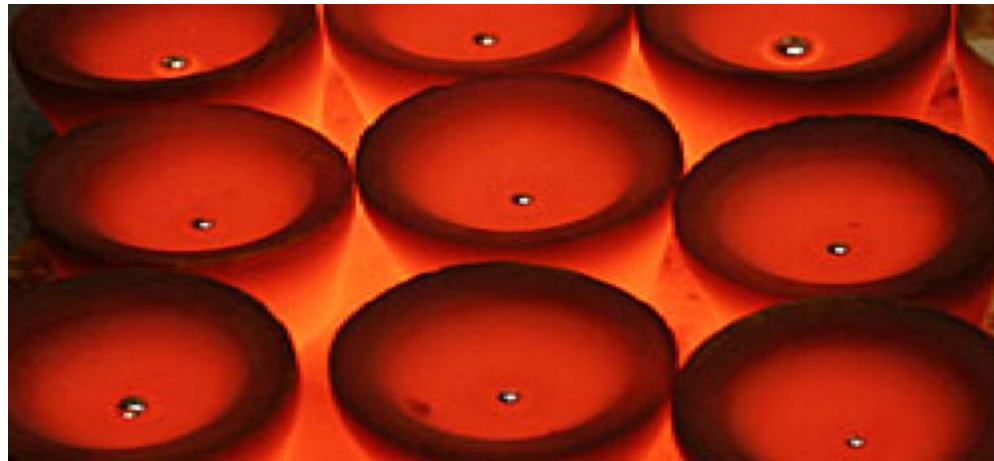
Fire assaying



Pouring of molten mass



Lead button



Shiny silver button containing precious metals



Digestion
& Analysis



MECL

Thank you so much