

TOFWERK icpTOF Specifications

icpTOF R and icpTOF 2R

Sample Introduction

| Parameter | unit | value icpTOF R | value icpTOF 2R |
|-----------------------------|------|---|-----------------|
| Access | - | Bench height, torch axis parallel to bench, minimized distances | |
| Peristaltic pump | - | Software controlled 12 roller, 4 channel mini-pump, inert rollers, low pulsation | |
| Peristaltic pump tubing | - | Three stop flared PVC pump tubing as standard | |
| Nebulizer | - | Concentric borosilicate glass with 400 μ L/min flow rate; PFA and high TDS optional | |
| Spray chamber | - | Baffled cyclonic, high purity quartz; PFA optional | |
| Spray chamber compatibility | - | Compatibility with all 6 mm OD nebulizers | |
| Peltier Cooling | - | Software control in range -10°C to $+20^{\circ}\text{C}$ | |
| Injector | - | Screw-in, self-aligning | |
| Injector sealing | - | No O-rings required | |
| Injector size | - | Wide 2.5 mm internal diameter as standard. Optional diameters available. | |
| Injector material | - | Quartz as standard. Optional materials available. | |

Plasma Ion Source

| Parameter | unit | value icpTOF R | value icpTOF 2R |
|---------------------------------|------|---|-----------------|
| Torch | - | Push-in, single piece, quartz | |
| RF generator | - | Digital, solid state RF generator | |
| RF generator | - | Dynamic swing frequency matching | |
| RF generator | - | No plasma shield required | |
| RF generator power range | W | 400-1600 (default 1550) | |
| Load coil | - | Water-cooled, silver coated, copper load coil | |
| Ar gas flow controllers | - | Coolant, auxiliary, nebulizer (Ar) | |
| Additional gas flow controllers | - | Two further MFCs for gas dilution, oxygen addition, laser ablation etc. | |
| Plasma TV | - | HD camera for remote monitoring of plasma status | |

Interface

| Parameter | unit | value icpTOF R | value icpTOF 2R |
|------------------|------|---|-----------------|
| Interface access | - | Drop-down door | |
| Sample cone | - | Solid Ni, 1.1 mm diameter (Pt tipped optional) | |
| Skimmer cone | - | Ni, 0.5 mm diameter (Pt tipped optional) | |
| Skimmer inserts | - | High sensitiv as standard (High matrix and robust as options) | |
| Interface pump | - | External, high performance rotary pump | |
| Extraction lens | - | Single, low voltage, conical | |
| Slide valve | - | PC controlled | |

Primary Ion Beam Optics

| Parameter | unit | value icpTOF R | value icpTOF 2R |
|--|------|---|-----------------|
| RAPID lens | - | 90° ion lens operating at a single fixed voltage | |
| Electrical connections to primary ion beam | - | Cable free, fixed position, spring mounted gold contacts | |
| Collision / Reaction Cell (Qcell) | - | Qcell flatapole design | |
| Qcell MFCs | - | 2 MFCs for pure He and reaction gas mixtures: O2, NH3/He, H2/He | |
| ion blanking | - | notch filter | |

TOF Mass Analyzer

| Parameter | unit | value icpTOF R | value icpTOF 2R |
|----------------------------------|-------|----------------|-----------------|
| Extractions per s | # | 33000 | 21700 |
| Mass Res Power ²³⁸ U | Th/Th | > 3000 | > 6000 |
| Abund Sens ²³⁸ U +1Th | # | 3.0E-04 | 3.0E-05 |
| Abund Sens ²³⁸ U -1Th | # | 4.0E-04 | 3.0E-04 |
| Mass Range | Th | 7-280 | 7-280 |

TOFMS Ion Detection System

| Parameter | unit | value icpTOF R | value icpTOF 2R |
|-----------------------------|------|----------------|-----------------|
| Detector type | - | MCP | |
| Integration time minimum | ms | 0.03 | 0.046 |
| sampling rate | GS/s | 1.6 | 1.6 |
| Linear Dynamic Signal Range | cps | 1 - > 1.0E+06 | 1 - > 1.0E+06 |

Performance

| Parameter | unit | value icpTOF R | value icpTOF 2R |
|---|---------|----------------|-----------------|
| Sensitivity in liquid ^{59}Co | cps/ppb | 10000 | 5000 |
| Sensitivity in liquid ^{115}In | cps/ppb | 20000 | 15000 |
| Sensitivity in liquid ^{238}U | cps/ppb | 50000 | 30000 |
| Oxides from liq sample $^{140}\text{Ce}^{16}\text{O}/^{140}\text{Ce}$ | % | < 2.5 | < 2.5 |
| Doubly chared $^{137}\text{Ba}^{++}/^{137}\text{Ba}^{+}$ | % | < 5 | < 5 |
| Short term stability 10min ^{238}U , max | % | 2 | 2 |
| Long term stability 6h ^{238}U , max | % | 5 | 5 |
| Bkg at 220Th | cps | < 10 | < 10 |
| Mass accuracy ^{238}U , max | ppm | < 5 | < 5 |

Vacuum System

| Parameter | unit | value icpTOF R | value icpTOF 2R |
|---------------------------------|------|--|------------------------------------|
| Configuration | - | Three stage, differential pumping | Four stage differential pumping |
| Turbo pump for primary ion beam | - | Split flow turbo molecular pump | |
| Second turbo pump | - | no | yes |
| Fore Vacuum | - | External backing rotary pump (common to interface) | |
| Venting | - | Vent valve operated with Ar for fast pumpdown | |
| MS switch for service | - | 30 min to switch between TOF and Q operation plus overnight pumpdown | |

QMS mode (e.g. for service)

Quadrupole Mass Analyzer

| Parameter | unit | value |
|--|--------|--------------------|
| Field | - | Virtual hyperbolic |
| Frequency | MHz | 2 |
| Mass range | Th | 2-290 |
| Scan speed (Li to U with 40 interval masses) | Th/s | > 3700 |
| Mass stability | Th/day | < +/- 0.025 |
| Abundance sensitivity at m-1 (m= 238U) | ppm | < 0.5 |
| Resolution | - | User definable |

QMS Ion Detection System

| Parameter | unit | value |
|---|---------------|---|
| Detector | | Dual mode discrete dynode electron multiplier |
| Minimum dwell time, in pulse and analog | μs | 100 |
| Dynamic range | cps | 1 - > 1.0E+09 |

Comment

Th = Thomson, unit for mass to charge ratio

1 Th = 1 u/e = 1 Da/e = $1.036426 \times 10^{-8} \text{ C}^{-1}$