C. Some useful experimental techniques

A list of useful state-of-the-art experimental techniques for studying chemical and physical nature of the SPDT process and other ultra precision engineering processes are shown in table C1. Table C2 shows the analytical techniques and the applications where these techniques are useful.

Table C1: Surface analysis techniques [303]

Detected radiation	**Incident radiations**				
	Electron based	**Ion based**	**X-ray photon based**	**Other photons based**	**E/M field**
Electron	TEM, SEM, STM, AES, LEED, RHEED, THEED		XPS		
Ion	MS	FIM, ISS, RBS, SIMS			
X-ray photon	EPMA		XRF, XRD, EDS		
Other photons				IR, Raman, ELL	
E/M field					NMR

TEM: Transmission electron microscope,
SEM: Scanning electron microscope,
STM: Scanning tunnelling microscope,
AES: Auger electron spectroscopy,
LEED: Low energy electron diffraction,
RHEED or RED: Reflection high energy electron diffraction
THEED or TED: Transmission high energy electron diffraction
MS: Mass spectroscopy
EPMA: Electron probe X-ray micro analyzer
FIM: Field ion microscope
ISS: Ion scattering spectroscopy
RBS: Rutherford backscattering spectroscopy
SIMS: Secondary ion mass spectroscopy
XPS: X-ray photoelectron spectroscopy
XRF: X-ray fluorescence
XRD: X-ray diffraction
EDS: Energy dispersive X-ray photo spectroscopy
IR: Infrared spectroscopy
ELL: Ellipsometry
NMR: Nuclear magnetic resonance
AFM: Atomic force microscope

Table C2: Useful analytical techniques and their applications

S.No.	Analytical technique	Applications
1.	Nanoindentation or Nano-impact test	Elastic and plastic properties
2.	SEM, AFM, profilometer or interferometer	Surface morphology
3.	Optical microscopy, SEM, TEM	Microstructure
4.	X Ray Diffraction or electron diffraction	Atomic positions/ material microstructure
5.	EDS and XPS	Chemical composition
6.	XPS, EDS, Raman spectroscopy, IR	Chemical bonding property
7.	Fluorescence confocal microscopy, HF etching, cross sectional microscopy, micro raman spectroscopy, Rutherford backscattering, photon backscattering, KOH etching, positron annihilation	Sub-surface damage
8.	While light interferometer or surface profilometer	Surface roughness
9.	DXR Raman microscope, Nomarski differential interference contrast microscopy, SEM, AFM	Brittle-ductile transition
10.	Cathodoluminescence, IR, Raman mapping analysis	Characterization of diamond tool
11.	Laue back reflection	Crystal orientation
12.	Keyence VHX-500F Digital microscope (for diamond tool 150x Zoom was found good)	Quantitative examination of Vb (tool flank wear length)