Analysis methods of LED components

The optimal analytical methods are possible based on various LEDs characteristic even for a phosphor, a package, and a product from a light-emitting device.

Light emitting elements

Analysis subject	Endpoint	Methods of analysis
Element	Appearance form	Optical microscope, SEM
	Leak	EL, SEM, TEM
	Operating temperature	Raman
Surface, back electrode	Composition	EPMA, AES, RBS
	Impurities	SIMS, TOF-SIMS, AES
	Film thickness	SEM, TEM
	Oxide, surface contamination	FT-IR, TOF-SIMS, AES, XPS
	Stress	Strain gauge, XRD, Raman
	Roughness	AFM, SEM
	Adhesion	NanoIndentation
Cladding layer	Composition	EPMA, AES , RBS, Raman, SIMS
	Crystal defect	PL, CL, TEM
	Impurities	SIMS, TOF-SIMS, ESR, Raman, CL
	Carrier density	SIMS, Raman, SCN
	P/N structures	SCM, SIMS
Active layer	Structure, shape	TEM
	Film thickness	TEM
	Impurities	SIMS, CL
	Composition fluctuations	STEM-EDX, CL
Substrate, epitaxial films, buffer layer	Stress	Raman, XRD, Strain gauge
	A defect, crystalline	PL, CL, Raman, XRD
	Impurities	SIMS, Raman
	Grinding damage	Raman, CL and AFM, X-ray topography

LED package

Analysis subject	Endpoint	Methods of analysis
Mold resin	Composition	FT-IR, solid state NMR, pyrolysis- GC/MS
	Shape, a crack	Optical microscope, SEM, X-ray analysis microscopes
	Impurities	FT-IR, NMR, ICP-MS
	Degraded state	Solid state NMR, FT-IR, UV-VIS, ESR
	Hardness	Nanoindentation
	Heating resistance	DSC, TMA
	Adhesion	Nanoindentation
	Gas permeability	Steady state method differential pressure
	Water absorption rate	Vapor, gas adsorption measurements
Lead frame	Plating thickness	SEM, TEM
	Coefficient of thermal conductivity	Frash method
	Roughness, convex shape	AFM, SEM
	Surface contamination	FT-IR, XPS and AES, TOF-SIMS
	Discoloration, corrosion	XPS, TOF-SIMS
	Optical reflectance	UV-VIS
Electrical bonding	Loop shape (Wire)	SEM, X-ray analysis microscopes
	Delamination (wire) Solder, LCF	SEM
	Residual stress	XRD, Raman
Phosphor	Composition	EPMA
	Dimensional standard	SEM
	Degradation	Solid state NMR, FT-IR, UV-VIS, ESR, Raman, PL, CL

Notes: One element to measurement is possible for method of underline notation.

LEDs light etc.

Analysis subject	Endpoint	Methods of analysis
Chemical capacitors	Appearance form	Optical microscope, SEM
	Electrolyte deterioration	FT-IR, HPLC
	Corrosion of the electrodes	X-ray CT, X-ray analysis microscopes, cross-section SEM
Ceramic capacitors、Tantalum capacitors	Appearance form	Optical microscope, SEM
	Sintered body degradation	SEM, CL
	Internal disconnection	X-rays analysis microscopes and fluoroscopically, opening observations
	Impurities	TOF-SIMS, EPMA

Analysis subject	Endpoint	Method of analysis
Rectifier diode	Appearance form	Optical microscope, SEM
	Internal disconnection	X-ray analysis microscopes and fluoroscopically, opening observations
	Semiconductor device failure	SEM, SCM
Power transistor Other Electronic Components	Joint problems	Optical microscope, SEM
	Internal disconnection	X-ray analysis microscopes, fluoroscopically, opening observations
	Deformity	Strain gauge, XRD, Raman
	Insulation fracture	An electrical properties tests, FT-IR
	In addition, deterioration	FT-IR, Solid state NMR, pyrolysis GC/MS