

◆ 固体电解质铝电解电容器失效模式及原因分析.

◆ Typical failure modes and factors of aluminum electrolytic capacitors.

Failure mode	Failure mechanism (internal phenomenon)	Production factor	Application factor
失效模式	失效现象	制造原因	使用原因
<pre> graph TD subgraph Failure_Modes [Failure modes] A1[Rubber bung bulge] --> B1[Internal temperature rises] A2[Reduction of Capacitance] --> B2[Reduction of anode foil capacitance] A3[Increase of tanδ] --> B3[Reduction of Cathode foil capacitance] A4[Increase of leakage current] --> B4[Infiltration of Cl-] A5[Short circuit] --> B5[Insulation breakdown of Al2O3 film and electrolytic paper] A6[Open circuit] --> B6[No full contact between leads and foils] end subgraph Failure_Mechanisms [Failure mechanisms] B1[Internal temperature rises] --> C1[Defect of oxide film] B2[Reduction of anode foil capacitance] --> C2[solvent not clean up] B3[Reduction of Cathode foil capacitance] --> C3[化成电压过高 over voltage] B4[Infiltration of Cl-] --> C4[化成电压过低 under voltage] B5[Insulation breakdown of Al2O3 film and electrolytic paper] --> C5[Burr(s) on foils or leads] B6[No full contact between leads and foils] --> C6[Leads not stitched well on the foils] end subgraph Production_Factors [Production factors] C1[Defect of oxide film] --> D1[Application of over voltage] C2[solvent not clean up] --> D2[Excessive ripple current] C3[化成电压过高 over voltage] --> D3[Application of reverse voltage] C4[化成电压过低 under voltage] --> D4[Severe charging-discharging] C5[Burr(s) on foils or leads] --> D5[Application of AC voltage] C6[Leads not stitched well on the foils] --> D6[Use in high temperature] end subgraph Application_Factors [Application factors] D1[Application of over voltage] --> E1[Use of Halogenated solvent] D2[Excessive ripple current] --> E2[Stress applied to leads] D3[Application of reverse voltage] --> E3[Aluminum case deformed] D4[Severe charging-discharging] --> E4[Aluminum case damaged] D5[Application of AC voltage] --> E5[Use in high temperature] D6[Use in high temperature] --> E6[Use of Halogenated solvent] end </pre>			
失效模式	失效现象	制造原因	使用原因
Rubber bung bulge 胶塞凸起	Internal temperature rises 内部温度上升	Defect of oxide film 氧化膜的缺陷	Application of over voltage 施加过电压
Reduction of Capacitance 容量下降	Reduction of anode foil capacitance 阳极箔容量减小	solvent not clean up 溶剂去除不尽	Excessive ripple current 纹波电流过大
Increase of tanδ 损耗上升 等效串联电阻上升	Reduction of Cathode foil capacitance 阴极箔容量减小	化成电压过高 over voltage 化成电压过低 under voltage	Application of reverse voltage 施加反向电压
increase of leakage current 漏电流上升	阳极箔氧化膜修补不到位	Metal particles attached to the aluminum foils 金属微粒附着	Severe charging-discharging 频繁充放电
Short circuit 短路	Infiltration of Cl- 氯离子的侵入	Burr(s) on foils or leads 铝箔、引线毛刺	Application of AC voltage 施加交流电
Open circuit 开路	Insulation breakdown of Al2O3 film and electrolytic paper 氧化膜, 电解纸的绝缘作用受到破坏	Leads not stitched well on the foils 引出线与铝箔铆接不良	Use in high temperature 使用温度过高
	No full contact between leads and foils 引出线与铝箔接触不充分	Mechanical stress 机械应力的施加	Use of Halogenated solvent 使用含卤素的洗涤剂
			Stress applied to leads 引线受到异常外部应力
			外壳受力变形 Aluminum case deformed
			外壳破损 Aluminum case damaged