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Reliability of passive electronic devices: failure mechanisms and testing

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Abstract:

Non-destructive methods for the quality characterization and reliability prediction of passive electronic devices are based on the VA characteristics, the nonlinearity index (NLI), electronic noise spectroscopy, electro-ultrasonic spectroscopy and acoustic emission. Leakage current value and its dependence on ageing time for the fixed temperature and applied voltage are frequently used as the reliability indicators for tantalum and niobium capacitors. It is shown that the self-healing processes can regenerate capacitor structure and then leakage current and noise decrease in affected samples. The frequency dependence of the noise spectral density in mHz region gives the information on slow irreversible processes. Acoustic emission and partial discharges signals can be used to localise the defect position in the foil capacitors. A noise and nonlinearity of resistors are used for detecting imperfections and abnormalities. It is shown that electro-ultrasonic spectroscopy intermodulation component is more sensitive to defects in resistors than the non-linearity index NLI.