Accelerated Simulation Method to Evaluate ELDRS of Bipolar Operational Amplifiers By Hydrogen Soaking

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Abstract

The Enhance Low Dose Rate Sensitivity (ELDRS) of bipolar devices is one of the important effects on space electronics systems that could be impact on its high reliability and long life. It is important to ensure radiation reliability for space applications by evaluating ELDRS of bipolar devices. However, the low dose rate irradiation test has a long period and high cost, so accelerated testing methods are required. In this paper, low dose rate, high dose rate and hydrogen soaking accelerated irradiation experiments are carried out on the operational amplifier circuit (XJ139), and the experimental data of high and low dose rate of the circuit are analyzed, the conclusion that the circuit has a ELDRS effect is given. Experiments on circuit irradiation effects under different hydrogen concentrations and immersion time were carried out. The degradation data of irradiation-sensitive parameters under different hydrogen soaking pretreatment conditions were analyzed. The optimal combination conditions for hydrogen soaking are given based on this circuit, and verified by experiments. At last, the degradation equivalence under accelerated hydrogen soaking and low dose rate irradiation test results is analyzed and discussed. The results show that the degradation degree of the samples after hydrogenation pretreatment after high dose rate irradiation is comparable to that of low dose rate irradiation. The research results can be used to guide the development of low dose rate accelerated tests and engineering applications.

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