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RANDOM VIBRATION AND STRESS ANALYSIS OF THE 3D-PRINTED MINIATURIZED HIGH-RESOLUTION MULTIPLE ELECTRODES HARMONIZED KINGDON TRAP

Abstract

Mass spectrometry is widely used for space exploration in situ, and it is an essential instrument for soil analyses in future Moon exploration missions. This instrument determines the substance chemical composition by identifying compounds through accurate mass measurements of their molecules. Miniaturization is a big challenge for space device development. To our mind the best candidate for high mass resolution mass spectrometer for space research is Kingdon ion trap based mass spectrometer which permits miniaturization without ruining analytical parameters. However, the harmful disturbances of the space environment can cause distortions in the ion trap assembly, which is sensitive to even small displacements and deformations that affects the operation process and increases the results' error. Vibrations and stresses are among such critical disturbances. In this study, we fabricated Kingdon ion trap prototypes, analyzed random vibration and stress for 3D-printed ceramic, stainless steel and silver traps, and validated the analysis by testing.