

PIDEC α : PHOTON INTERMEDIATE DIRECT ENERGY CONVERSION USING THE
ALPHA EMITTER POLONIUM-210

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ABSTRACT

This work details the development of two proof-of-concept Photon Intermediate Direct Energy Conversion systems using the α -emitter Po-210 (PIDEC α). Ch. I begins with a short history of nuclear battery development and then describes the expansion nuclear battery technology. It includes a review of recently published alphavoltaics in the literature, some shortcomings they exhibit, how these can be avoided with PIDEDEC, and the previous results seen with PIDEDEC systems. Ch. II describes the radioisotope sources used in the literature and compares their relative benefits.

The remaining chapters discuss the fabrication and testing of the gas- and solid-state PIDEDEC devices. Ch. III reviews the theory of PIDEDEC and describes the models used to predict the behavior of the systems. Ch. IV details the design and assembly of the experimental apparatus. Ch. V contains the methods used to enact the experiments. Ch. VI presents the results of the experiments and analysis of those results. Ch. VII contains the conclusions drawn from the work and methods for improvement beyond the proof-of-concept phase. Both systems demonstrate the conversion of kinetic energy into electrical energy by PIDEDEC. The results of the gas fluorescer system are encouraging; photon transport efficiency was hampered as may be useful after some improvements. The Gallium Phosphide (GaP) results currently discourage application in long-lived batteries.