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Diamond Betavoltaic Battery: H3-DBB

H3-DBV is a diamond-based betavoltaic device that uses tritium (H-3) as a power source and is currently in development by Arkenlight & the University of Bristol.

Betavoltaic devices are neither chemical batteries nor photovoltaic cells yet have characteristics of the two.

H3-DBV devices will produce a low power output but are extremely long lived. The H3-DBV has a lifespan of tens of years.

Once the load is connected to a betavoltaic device the power output of the device is completely predictable (see Fig.2).

The H3-DBV can trickle-charge capacitors, implying an increased power output can be released intermittently if necessary.

Betavoltaic devices have exceptional specific energy and energy density (see Table 1). This allows for small form factors that are beyond the capabilities of current battery technology.

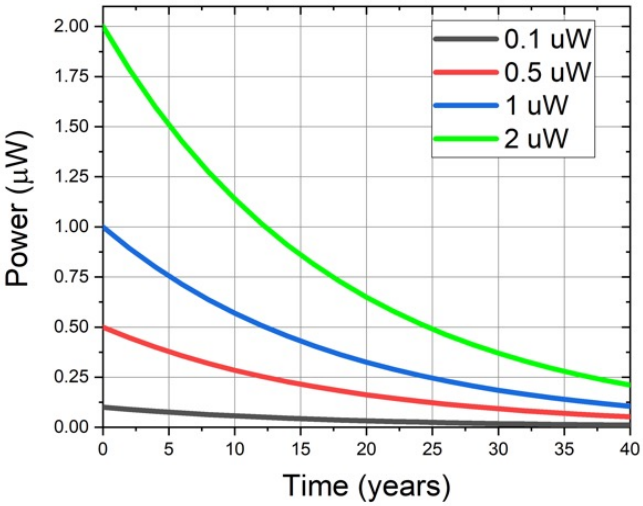

Figure 1 | Example of power output decrease with time of 3 betavoltaics devices with initial power outputs of 0.1, 0.5 and 1 uW.

Parameter	Symbol	H3-DBV	Chem Batteries
Open circuit Voltage	V_{oc} (V)	1.0 - 2.0	
Short Circuit Current	I_{sc} (nA)	60 - 1200	
Voltage at MPP	V_{MPP} (V)	0.9 - 1.8	1.2 - 3.9
Current at MPP	I_{MPP} (nA)	59 - 2400	
Power at MPP	P_{MPP} (μW)	0.1 - 2	
Specific Energy	E_s (MJ/kg)	3.28 - 26.6	0.1 - 1.6
Energy Density	E_d (GJ/m^3)	11.55 - 93.71	2e-4 - 0.006

Table 1 | Potential electrical parameters for H3-DBV devices. MPP =maximum point power. Voc = Open circuit voltage. Isc= short circuit current. The H3-DBV data presented in this document is based on simulations and the ongoing research efforts on betavoltaic cell prototype production. (The data for chemical batteries was taken from here)

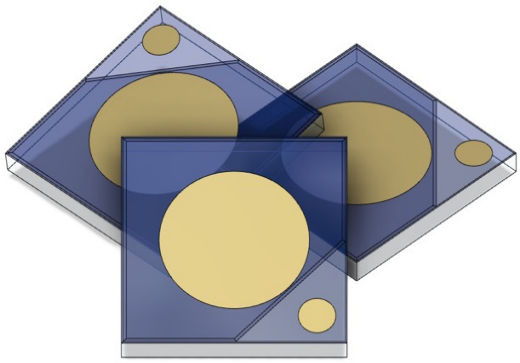

Figure 2 | Product design renders based upon experimental prototypes. Power density is relative to surface area, our prime cell structure is 3mm x 3mm x 20μm – though we can vary this according to your power requirements.