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Virtual Cathode lifetimes and floating potential measurements in a Polywell^{TM} fusion device MATTHEW CARR, JOE KHACHAN, School of Physics, University of Sydney — The Polywell ^{TM} is a spherically convergent ion focus concept first developed by R Bussard in the 1980s as a possible device for controlled thermonuclear fusion. The device aims to magnetically confine electrons with a quasi-spherical-cusp magnetic field, forming a deep potential well in the centre of the device, which can attract and maintain a high density of local energetic ions passing through the potential well. Careful design of the magnetic field and coil formers might help to substantially reduce the former/grid collision losses that plague other IEC devices. Floating potential measurements in the core of a Polywell have shown that a virtual cathode is established, with floating potentials of up to -250V obtained for milliseconds. The lifetime of the virtual cathode was determined only by the shape and duration of the magnetic coil current. This implies that currents of increasing duration will increase the lifetime of the virtual cathode. Further measurements reveal that virtual cathode formation could only be established within a narrow magnitude range of coil currents. We find that the floating potential increases with decreasing gas pressure.

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