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Direct Ion Energy Measurements at the RF Biased Electrode in Noble and Hydrocarbon Gas Discharges A. BABY, C.M.O. MAHONY, P.D. MAGUIRE, Nanotechnology and Integrated Bio Engineering Centre, University of Ulster — We report direct measurements of ion energy distributions at the biased substrate electrode in a RF ICP discharge using a mass-energy analyser thus allowing exploration of greater bias voltage and frequency ranges. IEDs for pure Ar, He and He:Ar or Ar:C_2H_2 mixtures for pressures up to 90mTorr, mean bias voltages up to 150V and bias frequencies up to 27MHz, are compared with existing single and multi-species [1] IED models. With associated Langmuir probe, ion flux probe and sheath width measurements we observe that lighter ion IEDs deviate from the model and this also affects interpretation of the multiple-species IED model. At high biases we also note deviation from models, probably due to additional capacitively-coupled power input at the substrate electrode. We have mapped the IED spread and peak intensity variation across frequency and pressure ranges, respectively, in order to exploit IED tailoring for technological applications, particularly for the deposition of high integrity carbon based films. In Ar:C_2H_2 narrow spread IEDs were achieved, required for new diamond-like carbon deposition and growth modeling. Mean energies up to 100eV were obtained with 15% - 20% spread, depending on gas ratio, pulsed bias and frequency. [1] Sobolewski M A et. al. *J. Appl. Phys.* **91**(2002) 6303.

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