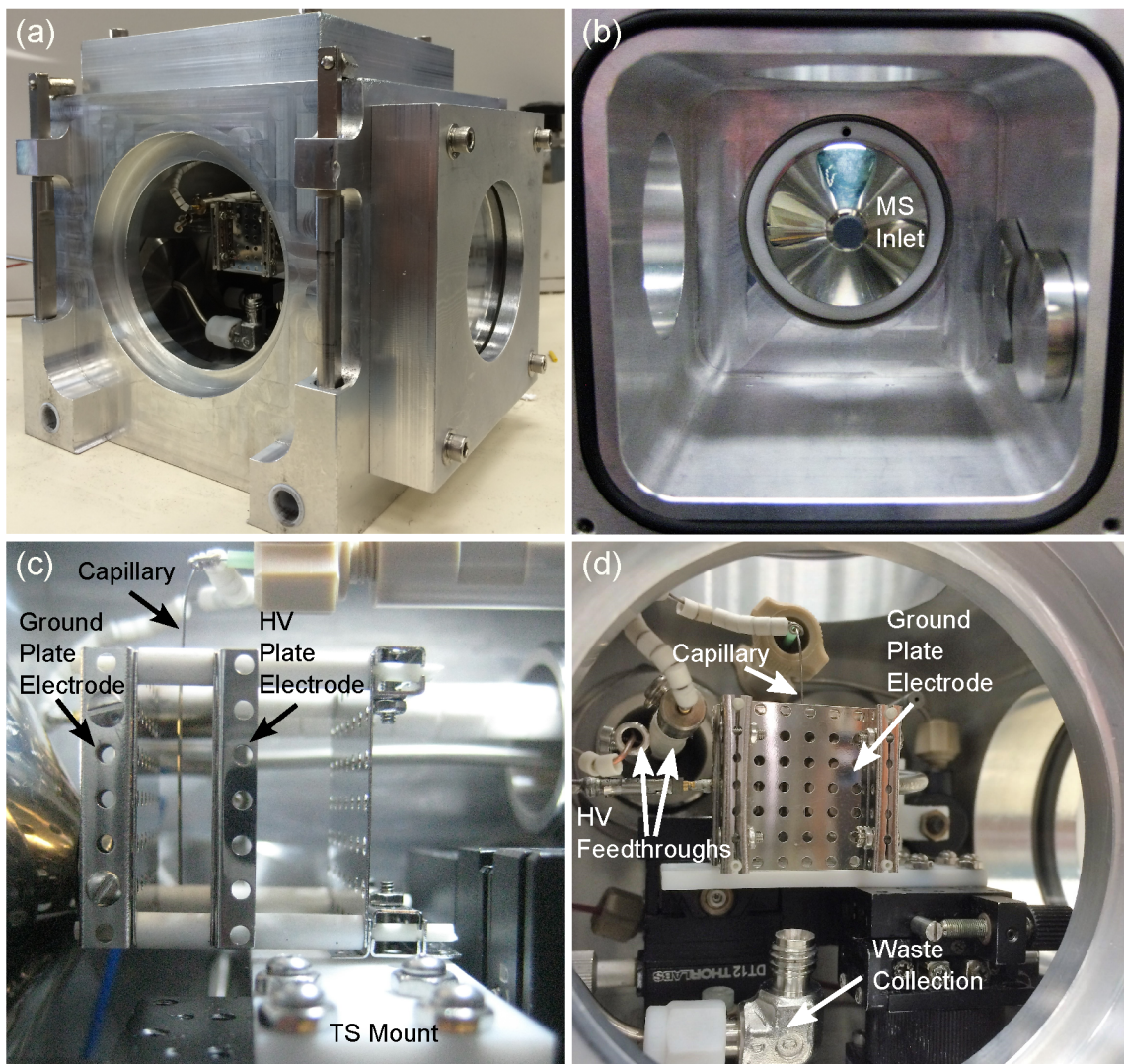


*Appendix A***Design of Enclosure for FIDI-MS Experiments in a Regulated Atmosphere**

The FIDI-MS source utilized in experiments in Chapter 3 is designed to allow for control of the ambient conditions in which suspended droplet chemistry is studied. The device consists of four main parts: an enclosure, a back plate, and two viewport plates, all machined by eMachineShop (Mahwah, NJ). The assembled source is shown in Figure A.1a. The interface with the mounts of the LTQ mass spectrometer is based upon a design for a custom electrospray stage by Priska D. von Haller at the University of Washington Proteomics Resource. The device seals to the front of the mass spectrometer by an O-ring present on the atmospheric pressure interface, normally utilized to seal commercially available atmospheric pressure ionization sources. Once mounted, the entire device can reach a vacuum pressure of approximately 10 Torr using only the draw of gas through the atmospheric pressure interface of the LTQ.

Shown in Figure A.1b is an image of the main enclosure mounted to the inlet of the LTQ mass spectrometer. The right side of the enclosure is equipped with two 1" baseplate apertures, which allow for the mounting of various feedthrough interfaces. For the experiments in Chapter 3, the apertures are mounted with 1/8 in. outer diameter (OD) feedthroughs (FCH-012S, Kurt J. Lesker, Jefferson, Hills, PA) to introduce sample to the FIDI capillary and collect waste droplets from the enclosure. The backing plate of the enclosure is also equipped with three 1" baseplate apertures and is sealed to the main enclosure by a Viton O-ring (McMaster-Carr, Santa Fe Springs, CA). The backing plate

holds a gas feedthrough (LFT421TETE, Kurt J. Lesker) to control the ambient conditions in the chamber and a high voltage feedthrough (A0507-1-QF, MPF Products, Gray Court, SC) to apply an electric potential to the FIDI apparatus.



**Figure A.1.** Enclosure for FIDI experiments to regulate ambient conditions. Shown in (a) is the assembled source, and the main enclosure mounted to the mass spectrometer inlet is shown in (b). Shown in (c) and (d) are two views of the FIDI apparatus mounted within the enclosure.

The enclosure is also equipped with glass viewport mounts on the top and left side of the device to allow for visual monitoring and to initiate photochemistry. The viewport mounts are based on a design detailed by Abbott and Scace in which the glass window is sealed on each side by compression of an O-ring, avoiding direct glass-metal contact.<sup>354</sup> Glass windows of 80 mm diameter and 12 mm thickness were obtained from OptoSigma (Santa Ana, CA), with the top window fabricated from BK7 glass and the side window fabricated from fused silica to allow for efficient UV transmission.

Within the enclosure, the FIDI apparatus is based upon a design described previously by Grimm and co-workers.<sup>83</sup> The source region is fabricated from eV parts (Kimball Physics, Wilton, NH), with the high voltage and ground plates (SS-PL-B7x7) mounted on ceramic rods (Al<sub>2</sub>O<sub>3</sub>-TU-B-2000) secured to a custom PTFE mount via a bracket (SS-BR-B2x7). The plates are held in position by a combination of screw clamps (SS-SC-B7) and ceramic spacers (AL<sub>2</sub>O<sub>3</sub>-TU-C-250). The mount is affixed to a translation stage (TS) for alignment with the inlet of the mass spectrometer. The stainless steel (SS) capillary (28 gauge, McMaster-Carr) is also connected to a translation stage by 1/16 in. OD stainless steel tubing (0.005 in. ID, Sigma-Aldrich, St. Louis, MO) for alignment between the two plates.