Technology Offer

High efficiency hydrodynamic collimation vacuum interface for atmospheric pressure ion sources

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In mass spectroscopy, many ion sources that transform the specimen to be tested into gas phase ions operate at ambient or elevated pressure. The generated ions have to be transferred into vacuum for further characterization, for instance in a mass analyzer.
The ion transfer into vacuum represents a major bottleneck. Because the pumping power increases rapidly with the size of an opening, long capillaries or small pinholes have to be used. Their transmission is commonly as low as 1%, in optimal cases 10% can be reached. An improvement of this figure is highly desirable, since the transmission of analyte ions is directly linked to the performance of the device as a whole in terms of sensitivity, the sample consumption, and measurement duration.

Technology

Scientists from the Max Planck Institute for Solid State Research and Technische Universität Berlin have developed a new type of atmospheric pressure interface for ambient pressure ion sources based on hydrodynamic considerations and ion trajectory computer simulations.
The hydrodynamically optimized inlet funnel is formed such that the flow of the background gas is utilized to counteract the space charge expansion of the ion cloud, which is the main source of losses. The interface is completed by a capillary and an outlet portion that is shaped to collimate the ion-gas cloud expanding into the vacuum chamber (compare Fig. 1).
This novel type of ion transfer device shows dramatically improved transmission of up to 100%. Used with a nano-electrospray source also a better stability of the ion source and a much larger acceptance volume for generated ions has been observed. Further, its simple construction makes the upgrading of present devices a simple task.

Advantages

- Very high transmission of up to 100%.
- No electric or magnetic fields required for guiding of ions. (Optionally, the transfer device can be combined with ion lenses.)
- Easy to manufacture with, e.g., electro erosion.

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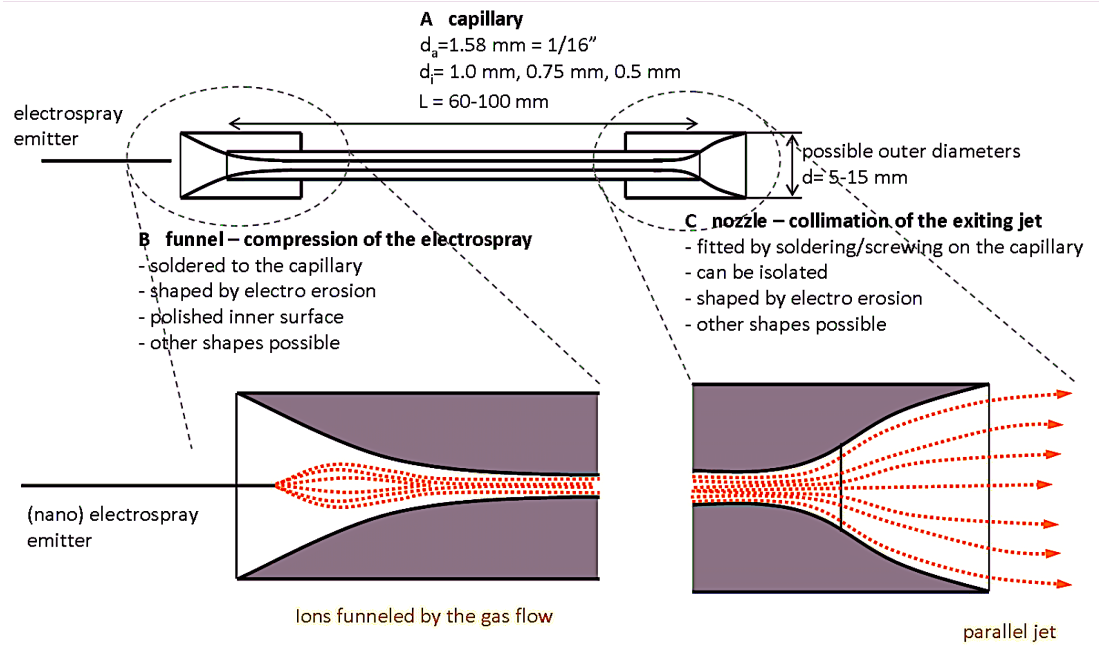

Fig. 1: Capillary (A) with hydrodynamically optimized funnel (B) and collimation nozzle (C). Typical dimensions of the transfer capillary assembly are shown. The expected ion flow is shown as dotted orange lines.

Patent Information

- Patent application filed February 2012.

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