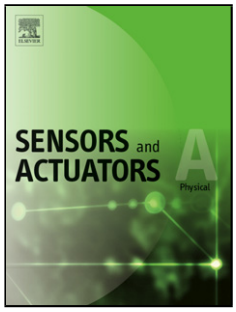

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A two dimensional ionic anemometer for very low flow rates

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Highlights

- A principle for a multi-dimensional flow sensor without moving parts and leeway, with superior performance as compared to classical vane probes.
- A method to generate and modulate large amounts of ions under normal pressure, and that is suitable to advance also other sensing methods such as Ion Mobility Spectrometry (IMS).

Abstract:

A two-dimensional double-cage flow meter for detecting very small rates of airflow using ionized air is demonstrated. A corona discharge inside a Faraday cage generates an ion cloud that expands outside the Faraday cage driven only by its own charge in the absence of any external electric field. Due to its slow movement, the cloud is highly sensitive to the movement of the gas matrix. The use of four collector electrode grids at 0°, 90°, 180° and 270° allows for precise determination of the vector of the airflow. The method proves to be linear and suited for flow rates at least between 0 and 1.6 m/s. It is also shown that Debye shielding reduces the effect of external electric fields on the ions while the charge of the cloud itself significantly influences its movement. Despite this, efficient control of the ions by external electric fields is possible.

Key words:

Anemometer, ion, 2d, low flow rate, Debye shielding, corona discharge

1. Introduction

To measure airflow, vane probes and different designs of hot wire anemometers are common. Micro-machined hot wire anemometers are often used in photoacoustic detectors as part of NDIR gas sensors. They allow for the measurement of very low flow rates [1]. Recently a 3-dimensional probe was presented [2]. These devices detect the expansion of a cloud of heated air with and