Experimental Study of Pressure and Flow Rate of Wire-to-Rod Ionic Wind Pumps

Po-Hao Wang, Tsrong-Yi Wen
National Taiwan University of Science and Technology, Republic of China
E-mail: tywen@mail.ntust.edu.tw

***Abstract*—The performance of a fan is usually characterized by the pressure-flow rate (P-Q) curves. Rotary fans are capable of creating big pressure drops and large flow rates. However, rotary fans have mechanical parts that come with annoying issues. For example, sweeping blades creates noise issues, blades have dust-deposition issues, motors have reliability issues, and etc. Ionic wind pumps, a new type of fans, work based on electrohydrodynamics. By charging air molecules and manipulating the movements of such charged molecules, ionic wind pumps have no moving parts and are flexible in physical configurations, eliminating several issues that rotary fans have. This paper presents the characteristics of wire-rod ionic wind pumps, focusing on how the P-Q curves respond to the changes of the corona voltages and the numbers of electrodes. The experimental setup follows the industry standard, the Air Movement and Control Association (AMCA) 210. The ionic wind pumps under test have a fixed-size enclosure. Three numbers of corona electrodes and three numbers of collector electrodes, i.e., different spacing between two adjacent electrodes, were tested at four corona voltages. The results show that the total pressure and the volumetric flow rate of the ionic wind pumps are proportional to the corona voltage. On the other hand, increasing the number of the electrodes does not always increase the total pressure of the ionic wind pumps, suggesting that the number of electrodes has significant effects on the total pressure. This comes from the fact that the electric fields get weaker when two adjacent corona electrodes get closer (more electrodes), however, the discharge energy gets stronger. The number of the collector electrodes can essentially change the characteristics of the electric fields as well.**