

Mobility Spectra of Air Ions Generated by Corona Discharge

M.Alonso* J.P.Borra**, J.P.Santos***, E.Hontañón*** and E.Ramiro***

*National Center for Metallurgical Research (CSIC). Gregorio del Amo, 8. 28040, Madrid, Spain.

**LPGP (UMR 8578 CNRS – Univ. Paris-Sud Orsay, F-91405) SUPELEC, F-91192 Gif Sur Yvette, France

***RAMEM S.A. Sambara, 33. 28027 Madrid, Spain. E-mail: e.hontanon@ramem.com

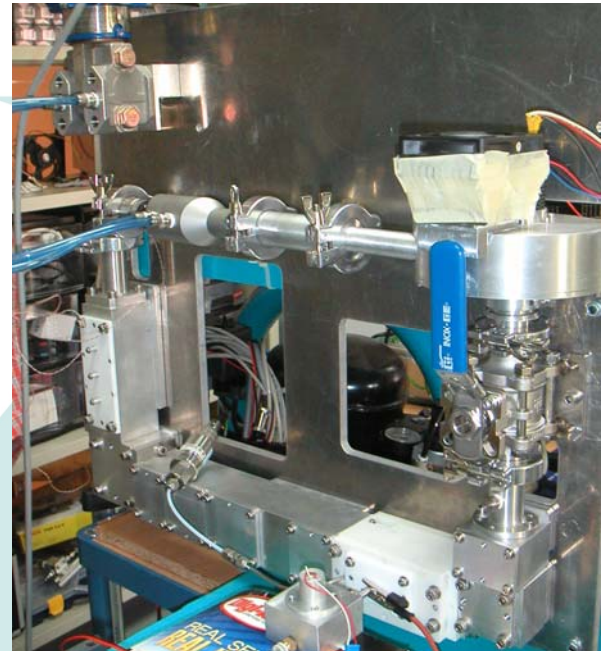
Introduction

The goal of this work is to determine the true mobilities of corona discharge-generated ions in air, and to study whether these mobilities depend on corona voltage.

Experimental

For the experiments, laboratory air was pumped, at a flow rate of 3 lpm, through a bed of silica gel and an absolute filter, into a corona discharge device (IONER corona charger, patented). The corona device consisted of a cylinder made of brass, a coaxial needle electrode, and a stainless steel plate, attached to the cylinder outlet, having a 4 mm orifice at its centre. Different voltages (in both polarities) were applied between the needle and the rear plate.

The mobility spectra of laboratory air ions generated by corona discharge have been measured using a novel, high-resolution differential mobility analyzer (IONER X1, patented). The DMA was operated in closed-loop mode, with a sheath flow rate of 270 lpm at the classification zone. The sheath flow rate, as well as the pressure and temperature at the classification zone, were calculated from the values measured at an upstream location. Measured mobilities were finally converted into reduced mobilities at 0°C and 1 atm using Langevin's formula.



IONER® X1 high resolution ion-DMA

Results

The spectra of positive and negative air ions are shown in Figs.1 and 2. The mobility distributions are normalized so that the area under each curve is constant. In this manner, the relative intensities for a given peak represent the relative abundance of that particular ion species at different corona operating conditions. It is seen that, regardless the ion polarity, an increase in corona voltage causes the spectra to shift globally towards lower mobilities (Fig. 3). This is a consequence of **increasing ion losses by electrostatic precipitation** within the corona device. In addition to this electrostatic loss effect, in the case of positive corona it seems that larger voltages favour the formation of rather low mobility species, i.e., large ions.

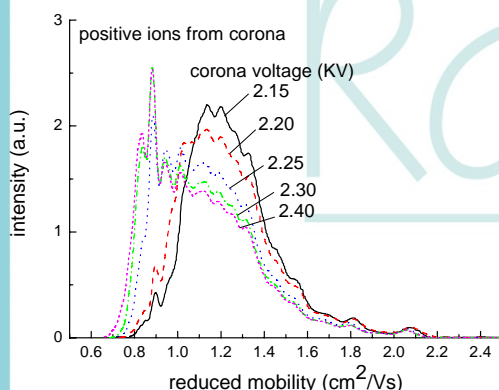


Fig 1: Relative positive ion distribution for different corona voltages

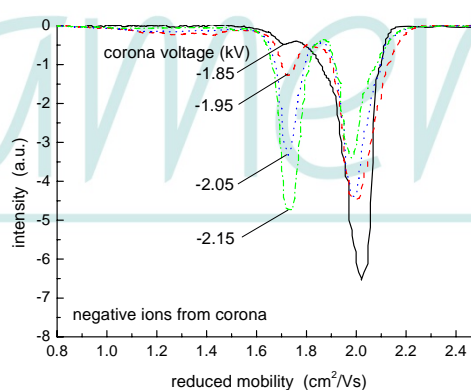


Fig 2: Relative negative ion distribution for different corona voltages

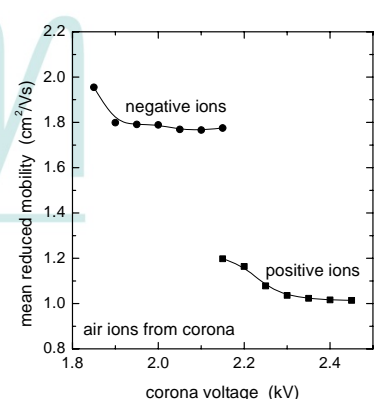


Fig 3: mean mobilities for positive and negative ions versus corona voltage

Conclusion

In conclusion, we have shown that the mobility distribution of laboratory corona air ions depends drastically on the operating conditions. This has large implications as regards to, for instance, the practical use of corona discharge devices for aerosol particle charging.

More information: <http://www.ioner.net> Contact us: ioner@ioner.net

Ramem s.a. Sambara 33 28027 Madrid Tel: (34) 91 404 45 75 Fax: (34) 91 403 45 96