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Measurements of EHD Flow Patterns in ESP with DC+Pulsed Voltage Hybrid Power Supply

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Abstract. Results of Particle Image Velocimetry (PIV) measurements in an electrostatic precipitator (ESP) supplied with high voltage pulses superimposed on DC voltage are presented in this paper. The ESP had a stainless-steel wire discharge electrode placed between two grounded, stainless-steel plate collecting electrodes. The DC high voltage (0-20 kV) with superimposed voltage pulses (0–30 kV), either positive or negative polarity, was applied to the wire electrode. We found no effect of the applied voltage pulses upon the flow patterns when there was no DC voltage. However, when the high voltage pulses were superimposed on DC high voltage, the flow patterns were affected significantly.

1. Introduction

For several decades electrostatic precipitators (ESPs) have been widely used as dust particle collectors. They are characterized by high total particle collection efficiency (up to 99.9%) with a low pressure drop. However, there has long been an interest in improving ESPs functioning and collection efficiency (especially of submicron particles which are weakly precipitated) [1-5]. One of the proposal to improve ESP functioning is to use a new kind of power supply with combined DC and pulsed voltage.

The aim of this investigation was to study the influence of the combined DC and pulsed voltage on particle flow patterns in the ESP. The Particle Image Velocimetry (PIV) method [6] was used.

2. Experimental apparatus

The apparatus used in this experiment (Fig. 1) consisted of an ESP, a high-voltage supply, and standard PIV equipment for the measurement of velocity fields.

The ESP had a single stainless-steel wire discharge electrode (diameter 1 mm, length 200 mm) placed in the middle of the ESP between two grounded, stainless-steel plate electrodes (200 mm wide and 600 mm long). The plate-to-plate electrode spacing was 100 mm. A flow homogenizer was placed before the ESP inlet.

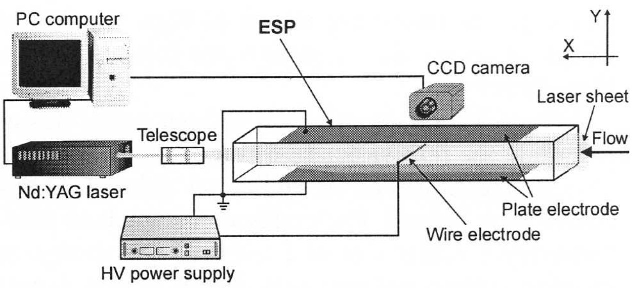

Figure 1. Schematic of experimental set-up.