Electrical and particle collection performance of an novel ESP with indirect charging method for corrosive and explosive gas cleaning

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Abstract—A novel two-stage ESP for IT manufacturing industry using highly corrosive and explosive gases developed that uses an indirect charger to generate negative ions at outside of a gas duct and put them into a main gas flow by using additional electric field[1]. The indirect charging stage (100 x 100 x 400 mm^3) is composed of brush type charger located at outside of upper part of the charging stage and two parallel plates to which high voltage and ground were connected to generate electric field. At downstream of the charging stage, a collection stage was located with a collection area of 0.1 m^2 at 50 L/min. Electrical and particle removal characteristics of the ESP was evaluated with ultrafine particles by varying the geometry of the ionizer, applied voltage and polarity of the power source. The total air flow rate for the test were approximate 55 L/min with 10 : 1 ratio of main and mixing flows in the ESP. With our novel concept of indirect charging stage, when high voltage of – 5 kV between a brush charger and a bottom plate was applied, electric potential between upper and bottom plates was generated automatically due to induction between tip of the charger and upper plate, and the potential was changed by varying geometry of the upper plate such as thickness and size. Collection efficiency over 90% against 100 nm particles was achieved with applied voltages of – 5 kV to a charger, and of -10 kV to collection plates. This indicates that highly efficient collection of ultrafine particles in corrosive and explosive gases is possible without any contact of a corona charger with dirty exhaust gases from IT manufacturing.

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REFERENCES

[1] H.J. Kim, B. Han, C. G. Woo, J.P. Yoon, S.J. Park, and Y.J. Kim, "Ultrafine particle collection performance of an two-stage ESP using a novel mixing type carbon brush charger and parallel collection plates," presented at the 2015 IEEE IAS Annual meeting, Dallas, TX, Oct. 18–22, 2015, Paper 2015-EPC-0493.