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PROGRESS IN ELECTROFILTRATION FOR GAS CLEANING

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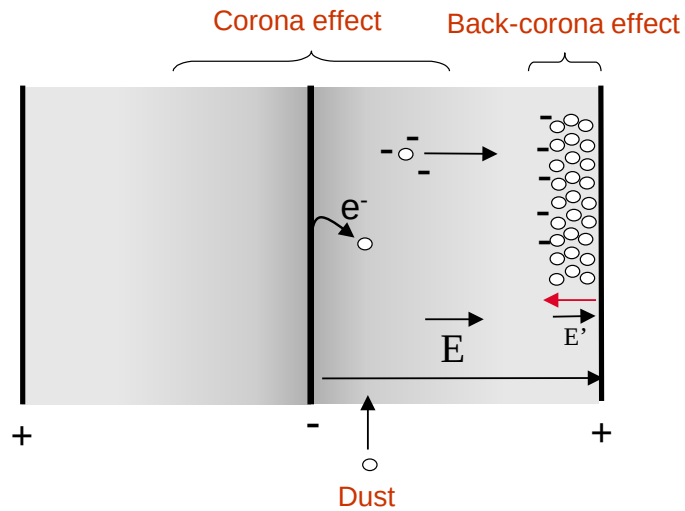
Industrial thermal processes generate a large amount of gases to be treated before released to atmosphere. Filtration is one of the major steps of this treatment as it ensures no release of solid particles. In any given field, electrostatic precipitators are technologies of choice because of several reasons: they avoid significant pressure drop in industrial systems; they do not need any filtering media; they may have simple geometry; their cleaning is easy; …

These reasons explain why this technology is particularly attractive when the thermal treatment is applied to radioactive material and then why the CEA works for several years to improve electrostatic precipitation applied to its needs. The main objective of the research and development performed in this field was to increase the filtering efficiency of the filters together with their endurance. After more than ten years of work, objective has been broadly reached and can be applied to various applications, nuclear or not.

Initially driven by a simple voltage regulation imposed by back-corona discharge formed by a series of micro-discharges in the air space between dust particles deposited on the collecting tubular electrode, researches have led to propose new way of operating. Thanks to modeling of electrostatic field in the tubular system, the geometry of emissive electrode has been changed in order to improve the electronic discharged in the gas stream and then the driving of the dust from the middle of the filter up to the collecting electrode. Furthermore, studies performed to work at voltage higher than breakdown voltage have led to propose new power supply combining direct voltage together with pulsed voltage. In this case, the final goal is to adjust the pulse frequency in such a way that one could work with over voltage without arc formation.

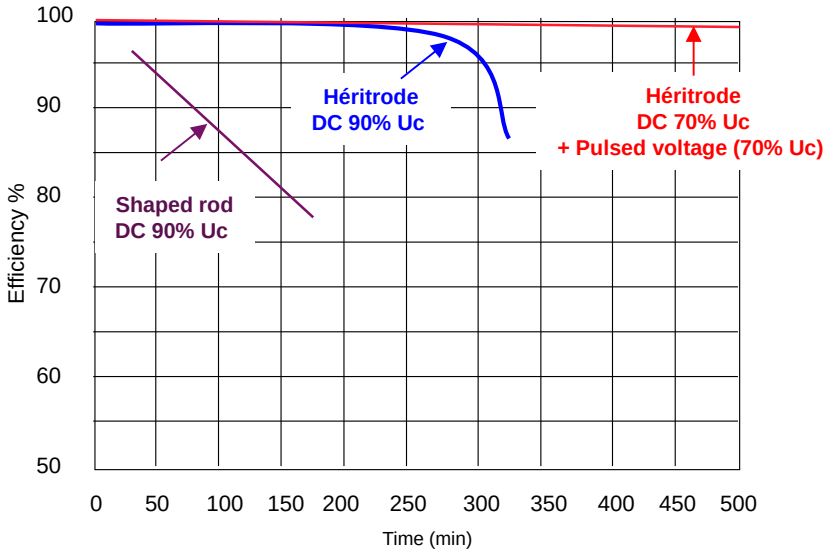


Principle of electrostatic precipitation

That package of progress led to propose new generation of electrostatic precipitator able to maintain efficiency greater than 99% for several hours. This is essential to

facilitate the operation of the processes connected to this type of filter and to avoid the clogging of the high efficiency filter located downstream.

The major purpose of the present paper is to explain the different steps of research that have led to pass from a few tens of minutes of optimal efficiency up to several hours. Electrode geometry, electrostatic field modeling, high-voltage direct and pulsed current, sonic and ultrasonic cleaning … were at the heart of these developments and have led to very conclusive results that can be applied to several applications



Evolution of the filtration efficiency according to technical progress