An Aerosol Neutralizer for Large Scale Testing of HEPA Filters

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ABSTRACT

Mississippi State University Institute for Clean Energy Technology (ICET) is in the process of evaluating the performance of AG-1 section FK radial flow high efficiency particulate air (HEPA) filters. The test that has been developed for this testing is capable of air flows of 113.4 m^3/min (4,000 cfm) to differential pressures of 1 kPa (40" wc). Aerosols generated for the high efficiency particulate air (HEPA) filter test stand will become highly charged as they are produced. Neutralization of the surface charged distribution to the Boltzmann equilibrium is necessary before particle size measurements are made or before the aerosols are captured by the test filters. This is accomplished in a bipolar neutralizer employing four 1.48 x 10^9 Bq (40 mCi) Strontium-90/Yittrium-90 (Sr-90/Y-90) beta sources. Beta particles from the Sr-90/Y-90 sources produce ion pairs as the traverse the HEPA test stand. This paper discusses the methods used to calculate and measure the ion pair density within the HEPA stand and to demonstrate the effectiveness of the design.

The Sr-90/Y-90 sources produce two energetic beta particles (546 keV and 2.26 MeV). The 2.26 MeV beta particles are produced by the Y-90 decay and are energetic enough that they produce a linear ion pair density along their path of travel. The 546 keV beta is produced by the decay of Sr-90 to Y-90 and is low enough in energy to have a higher probability of interacting with the air within the test stand. Therefore, ion pair production will be much higher in some sections of the test stand relative to others.

Criteria for the general design of an effective aerosol neutralizer is 6 x 10^6 ion pairs per second per cubic centimeter. Design calculations for Mississippi State University's unit predict generation of 1.4 x 10^7 ion pairs per cubic centimeter. Measurements of charge densities by the radioactive sources have been done using Landauer™ nanoDot™ dosimeters. Distribution of the dosimeters within the HEPA stand and results of the measurements are discussed. The effectiveness of the system has also been evaluated by aerosol measurements and results of this study will also be discussed.