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An Optimised System for Measurement of Radon Levels in Buildings by Spectroscopic Measurement of Radon Progeny

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Radon gas, 222Rn, is a problem in many buildings. The radon gas is not harmful in itself, but the decay chain contains charged elements as 218Po, and 214Po ions which have a tendency to stick to the lungs. Alpha particles from the decay of these ions cause damages to the lungs and increase the risk of lung cancer. Exposure to radon is estimated to cause between 3-14% of all lung cancer cases, depending on the average concentration in the country. Recently the limits for radon levels in buildings have been reduced by the World Health Organisation, to 100Bq/m3, increasing the need for fast and efficient methods to measure radon levels. The initial decay of 222Rn occurs in free air and could be detected using the principle of an ion chamber. However some of the decay products are charged and can be electrostatically collected on a semiconductor detector where further decays are easily detected. In this project we have developed a method to measure the decay of 218Po, and 214Po using a semiconductor detector with spectroscopic readout. These results could then, in combination with information on temperature and humidity, be used to calculate the original content of 222Rn in the air.

The system for measuring the radon progeny consists of a metal net cage, a silicon detector and spectrum analysing readout electronics. Radon diffuses into the cage and the radon progeny from the decays inside the cage is electrostatically collected on a silicon detector connected to spectrum analyser electronics. It is then essential to measure the ratio between the two energy peaks to verify that the counts results from 222Rn decays inside the cage. An excess amount of 214Po decays indicate that isotopes from decays outside the cage are collected on the detector. The system, which also contains sensors for temperature and humidity, is relatively fast and can be used both for measuring radon content and for controlling ventilation systems. In the current project we have tested different cage volumes, detector sizes and collection voltages to optimise the system. In addition the effects of humidity and temperature have been verified with the optimised system.

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