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قســـم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of 15 – 25c and relative humidity 20-40 %

بالرسالة صفحات

لم ترد بالأصـــــل

شبكة المعلومات الجامعية

بعض الوثائق

الأصلية تالفة

Faculty of Science
Physics Department

CALIBRATION AND CONCENTRATION MEASUREMENTS OF RADON GAS IN RADON GAS CHAMBER

BY

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Thesis

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TO

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ıin Shams University
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'itle : **Calibration and Concentration Measurements of Radon Gas in Radon Gas Chamber**

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Prof. M. A. Khasha

to

Mother ..

Father ..

Brothers ..

and to my wife Manal

with my lovely daughter

Mariam .

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SUMMARY

Summary

Radon is the only gas member in the middle part of the long radioactive series begin by the widely distributed element ^{238}U. Therefore, radon is found in all environmental atmospheres with high emanation power and great tendency to migrate from its sources. This give the radon problem its important. ^{222}Rn has two facets; it posses a grave health hazards and it helps in mineral exploration, earthquake prediction, study of volcanic activities and search for geothermal energy sources. Therefore radon may be harmful or helpful.

Several techniques and methods are in use for measuring radon and its daughters. Long term measurements in form of solid state nuclear track detector (SSNTD) is very important to incorporate the effects of seasonal, weather and environmental fluctuation of radon emanation and its migration which responsible for varying the radon intensities. Therefore, be representative of the actual conditions existing in the area. CR-39 has to become the state of-the-art track detector for environmental radon which used for the measurements of the time-integrated radon level without needing of delicate and sophisticated equipment and it is portable, inexpensive and greatly convenient in rugged and remote areas even without a vehicular access.

The work divided mainly into four parts;

• Assured firstly the sensitivity of the used detector (PATRAS / CR-39) before going on the measurements of radon gas, and its optimal conditions were determined and fixed in all measurements. It was found that the optimum etching conditions are 6.25 N-NaOH at 70 °C for 6 hours. Also the characteristics of the detectors were studied including the determination of the bulk etch rate and the track diameter at different normality, temperature and etching times for some alpha energies. The bulk etching rate is equal to 1.6 μm/hr under the used optimum

etching conditions The activation energy for the detector bulk material is equal to 0.745 eV

- National Institute for Standard (NIS) radon chamber was equipped with Plexiglas shutter for irradiation of SSNTD without disturbing the equilibrium. Raising the chamber temperature based on direct warming of air inside the chamber by using a heater connect with a temperature controller from outside which measures and controls the chamber temperature. The used range is from 25 °C to 80 °C. The humidity was varied by pumping a water vapor inside the chamber and it was adjusted and controlled manually by varying the pump operating rate. The humidity was varied form 30 % to 80 %. The radon back ground of the chamber was measured and it was equal to (13 Bq m^{-3}) which gives a comparable value to the radon concentration in the ordinary environment. The radon distribution inside the chamber was studied by irradiating the detectors at different heights using two modes (Bare- and Can-modes) of irradiation. Also the effect of actuating the electric fan to homogeneously distribute the radon gas inside the chamber was studied.

- NIS radon chamber as an integrating concentration radon chamber with its Uranium ore stone source (Betchblend) was used to calibrate the detectors for radon and Working Level (WL) measurements. The concentration of radon inside the chamber equal to 18.13 kBq m^{-3} which measured by using a calibrated charcoal canisters and radon monitor. The procedure of calibration based on irradiate the detectors at the two configurations for different effective times ranged from (2-22) days, where irradiation takes place before and after reaching equilibrium and the integrating radon concentration was computing by using a theoretical equation. The track density ratios of Bare- and Can- modes was used to determine the equilibrium factor which gave a value equal to 0.84 ± 0.015, this factor was used to get the number of WL.day and then, the calibration factor, which is the main factor affect the quality of radon monitoring, can be determine. The results show that the calibration factors of CR-39/PATRAS are; 0.18 ± 0.015 $Tcm^{-2}\ d^{-1}$ / Bqm^{-3} and 2276 ± 307 $Tcm^{-2}\ d^{-1}$ / WL for radon and WL respectively.

- The measurements of radon gas by CR-39/PATRAS were performed at different environmental conditions. Firstly, the detectors were irradiated at different temperature ranged from 20 ^{o}C to 80 ^{o}C at a constant humidity (25%). Secondly, the detectors were irradiated at different humidity ranged from 30 % to 80 % at a constant temperature (27 ^{o}C). The result shows that the CR-39/PATRAS give a good response up to 60 ^{o}C temperature and 60 % Relative humidity.

Contents

CHAPTER 1: INTRODUCTION

CHAPTER 2: RADON

CHAPTER 3: SOLID STATE NUCLEAR TRACK DETECTORS

CHAPTER 4: INSTRUMENTATION AND EXPERMINTAL WORK