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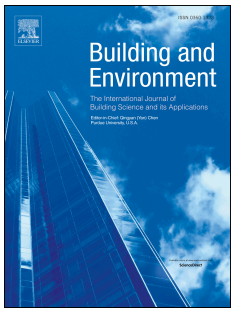

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Simultaneous Determination of the Radon Diffusion Coefficient and the Free Radon Production Rate From Compact Porous Emanation Media

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Abstract

The radon diffusion coefficient and the free radon production rate are important parameters for used to describe the migration of radon in porous emanation media. However, the method currently used to determine these two parameters is complicated. Based on a theory of the radon exhalation by diffusion from the inner and outer surfaces of a circular tube, a method to determine these two parameters in compact porous emanation media was proposed, and an experimental measuring device was designed and manufactured. The experimental device was used to simultaneously measure the radon exhalation rate from the inner and outer surfaces of a quarter-circular tubular concrete block filled with fine-grained uranium tailing sand. The measurements were used to calculate the radon diffusion coefficient and the free radon production rate. The result obtained by using this method shows that accuracy was within the accepted range of experimental error. This method has practical value for the simultaneous determination of the radon diffusion coefficient and the free radon production rate from compact porous emanation media.

Keywords: Radon, Diffusion coefficient, Production rate, Compact porous emanation media

1 Introduction

Radon is a radioactive gas. When inhaled, the radioactive particles from radon can damage the human respiratory system and increase the risk of lung cancer (Darby et al., 2005; Denman et al., 2015; Killip, 2005; Nikezic, 2006). The World Health Organization has reported that radon is one of 19 major carcinogens (WHO,2009), second only to cigarettes, that can cause lung cancer in humans (Pavia et al., 2003). Radon in buildings is mainly produced by radium-bearing building materials and soils (UNSCEAR, 2000; Nazaroff and Nero, 1988), whereas underground radon is emitted from radium-bearing rocks (Zhang et al., 2010). Radon is continuously released from the surface of radium-bearing materials and measures need to be taken to reduce its occurrence in areas where it might cause harm. The technology of reducing levels of radon requires research on its migration and release from radium-bearing materials. The radon diffusion coefficient and the free radon production rate from porous media are important physical parameters.

The radon diffusion coefficient is related to the pore structure of the material, the temperature and the humidity. It is often used to describe the ability of radon to migrate in porous media and its value

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