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Residual radioactivity of treated green diamonds

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Content

Treated green diamonds from the diamond trade can show residual radioactivity, generally due to irradiation by direct contact with radium salts, usually RaBr2. This treatment, which is thought to be obsolete nowadays, was initially used to turn diamonds green, an attractive colour, by creating colour-centres in the diamond lattice with alpha particles in the few MeV range. The diamonds modified with this method are rare on the market but can represent, in some cases, a potential risk for consumer's health by direct irradiation or contamination when radium salt residues remain in the open cracks and cavities of the gemstone. In this paper we will report various activity measurements conducted on two radioactive diamonds: a 0.5-carat gem affected with high residual radium contamination and a seven-carat diamond with no residual radium contamination. In both cases, the activity was characterized by alpha and gamma-ray spectrometry, and the radon emanation was measured by defined solid angle alpha measurements of a frozen source. It appeared that, even when no residual radium contamination can be identified, a measurable alpha and high-energy beta emission can be detected. This emission is due to the implantation of solid radon daughters in the diamond lattice due to the recoil energy from the alpha transition. By radioactive decay, these radon daughters eventually decay towards 210Pb, a 22.3 years half-life radionuclide, producing by beta transition 210Bi, a high-energy beta emitter and 210Po, an alpha emitter. The implantation thickness of the radon progeny is small enough to allow the escape and detection of the particle emission from the diamond crystal. The paper also discusses the potential health impact of these radioactive diamonds and their status with regards the regulatory policy for radioactive products.

About the Presenter

Dr Philippe Cassette is an international expert of the French Atomic Energy commission, specialist of radionuclide metrology at the Laboratoire National Henri Becquerel, the National Metrology Institute of France. He published more than 60 papers in the field or radionuclide metrology and especially in the development of liquid scintillation counting techniques for radionuclide standardization.He is an associated member of ICRM.

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