Ultrasonic Identification of Copper Canisters to be used for long term geological repository

Abstract:
Nuclear safeguards applications require highly specialized and secure systems for identification and authentication of copper canisters that has been recently introduced for long term geological repository of nuclear spent fuel. Following an ultrasonic characterization of velocity and attenuation of copper cylinders, a numerical model for the scattering of a set of Flat Bottom Holes (FBHs) randomly placed on a circular path is implemented. The random position, height and diameter of each FBH is used to generate a unique ultrasonic fingerprint that can be acquired with an ultrasonic probe scanning the surface of the copper canister along the circular path where the centers of FBHs are placed. According to the copper lid geometry a new method is required for the identification of the copper canisters; a solution is proposed with inclined FBHs with reduced distance from the probe in order to achieve high signal to noise ratio at 5 MHz. This solution can be easily implemented with an immersion probe thanks to the existing copper lid external cavity that can be filled with water. The characteristics of the ultrasonic fingerprint are analyzed in term of dynamic and robustness for identification with laboratory prototypes.

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