

**GAMMA RAY ATTENUATION COEFFICIENTS OF  
CARBON STEEL MATERIAL USING D7 FILM  
AND ION CHAMBER DETECTORS**

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## ABSTRACT

Attenuation coefficients ( $\mu$ ) are the probability of a radiation interacting with a material. Measurement of gamma radiation attenuation coefficients on carbon steel material has been made for material studies and industrial applications. The attenuation coefficients of the material were determined at constant energy using gamma radiation emitted from a point source of 25 Ci and 1.94 Ci of Iridium-192. The material used has various thicknesses ranging from 0.3 to 1.0 cm. Two types of detectors were used; D7 film and ion chamber. Different detectors are significant to determine the consistency of the attenuation coefficients for the same material. The material was collimated with lead sheets. Broad beam of gamma radiation was used for both experiments. The beam geometry affects the recorded number of photons due to scattering processes. Optical densities in film radiography were obtained for the exposed films and unabsorbed radiation density. Radiation intensities for the attenuated and unabsorbed radiation were obtained directly in ionization radiography. These parameters were then used to determine attenuation coefficients of the material using Beer's Lambert law. The coefficients are found to be exponentially decreased with thickness. The change in attenuation coefficients obeyed the Beer's Lambert law. Comparison  $\mu$  coefficients between film and ion chamber shows a high percentage difference in range 61% to 74%.

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background**

Non-destructive testing (NDT) is widely used in science and industry to evaluate properties of a material, component or system without causing damage. The inspections made using this NDT technique would not affect a product's final use which then provides a good balance between quality control and cost effectiveness. Some of the common examples of NDT techniques are radiography, eddy current, ultrasonic, magnetic penetrant and liquid penetrant. Each technique has their own functions that suited for a particular task and has different advantages. Generally, NDT is applied to prevent accident, ensure product reliability and also to make profit for the users.

In this study, radiography testing was used which can be defined as a process of testing material that uses penetrating radiation sources such as X-ray or gamma rays. X-rays was discovered by W.C. Roentgen in 1895 and Becquerel discovered radioactivity in 1896.