

**GAMMA-RAY ATTENUATION COEFFICIENTS OF  
CARBON STEEL PLATES USING IRIDIUM-192**

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**FACULTY OF SCIENCE  
UNIVERSITY OF MALAYA  
KUALA LUMPUR**

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CARBON STEEL PLATES USING IRIDIUM-192**

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**ORIGINAL LITERARY WORK DECLARATION**

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Field of Study : **Theoretical Physics**

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## ABSTRACT

Measurement of gamma radiation attenuation coefficients on carbon steel using gamma radiation beam from Iridium-192 has been made to permit their use for precision measurement, material studies and in various industrial radiographic techniques. The material examined is carbon steel plates with various thicknesses ranging from 2 mm to 13 mm. There are two aspects in this study; determination of the attenuation coefficient using theoretical method, and from experiments. Two types of detectors are used; the film radiography and ion chamber. The gamma ray source is the polychromatic radionuclide Iridium-192. Cross section of the incoherent scattering of every element in the carbon steel material sample has been calculated using the Klein-Nishina formula incorporating the structure function correction. We integrate the Klein-Nishina formula using the Gauss-Legendre quadrature and the cross section agrees very well with the published results. The cross section of the incoherent scattering is used to calculate the theoretical effective linear attenuation coefficient and is found to be  $0.231 \text{ cm}^{-1}$ . The effective linear attenuation coefficient value from the two experiments has the value of  $0.340 \text{ mm}^{-1}$  as determined from the transmission curves which is consistent with the theoretical value.

## ABSTRAK

Pengukuran pekali pengecilan bagi sinaran gama untuk keluli karbon telah dilakukan menggunakan alur sinaran gama daripada Iridium-192 bagi penggunaan untuk pengukuran ketepatan, kajian bahan dan dalam pelbagai teknik radiografi industri. Bahan yang dikaji ialah kepingan keluli karbon dengan pelbagai ketebalan bermula dari 2 mm hingga 13 mm. Terdapat dua aspek dalam kajian ini; penentuan pekali pengecilan menggunakan kaedah teori dan eksperimen. Dua jenis pengesan yang digunakan; radiografi filem dan kebuk ion. Sumber sinaran gama ialah radionuklid Iridium-192 polikromatik. Keratan rentas bagi serakan tak koheren bagi setiap elemen sampel bahan keluli karbon dihitung menggunakan formula Klein-Nishina dengan menggabungkan pembetulan fungsi struktur. Kamiran formula Klein-Nishina dilakukan menggunakan kuadratur Gauss-Legendre dan keratan rentas adalah bersetuju dengan keputusan yang diterbitkan. Keratan rentas serakan tak koheren digunakan untuk menghitung secara teori pekali pengecilan linear di mana nilainya adalah  $0.231 \text{ cm}^{-1}$ . Nilai pekali pengecilan berkesan diperolehi daripada kedua-dua eksperimen adalah  $0.340 \text{ cm}^{-1}$  seperti yang ditentukan dalam lengkungan graf penghantaran dimana nilai ini konsisten dengan nilai teori.

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