Development of a Calculation Code for Attenuation Coefficients

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Our code EXVol to calculate the detection efficiency of voluminous sources [1] cannot consider the attenuation edges in low energy region. In order to improve the performance of EXVol, an accurate and efficient calculation of the coefficients is required. So a code has been developed which calculates the attenuation coefficients by MATLAB. It closely follows the algorithm of the existing code XCOM [2] with an addition of GUI (Graphic User Interface). The performance of the code has been checked.

I. Methods

This code can generate the attenuation coefficients on an energy grid or on a grid selected by the user. And it returns a table of total attenuation coefficients (with or without coherent scattering) and figures of the tabular data which include all absorption edges. The code also provides the component attenuation coefficients due to coherent scattering, incoherent scattering, photoelectric absorption, pair production in the field of the nucleus and electrons, respectively. This code is written to calculate for elements, compounds and mixtures. The elemental data are based on Hubbell's work [3] as given in the XCOM [2]. When the code starts to operate, a window for input values is generated. This window treats the information on the designation of element or compound, energy range or a single energy of interest in eV. Elements are described by their chemical symbols in upper and lower cases and the acceptable atomic numbers are from 1 to 100. Compounds and mixtures are entered similarly to elements and the molecular formula is used to calculate the attenuation coefficient by weight of the individual atomic components. The output unit of attenuation coefficient is given in cm^2/g and a graph is plotted in log-log scale.

II. Result and Conclusion

An example is shown in figure 1. The accuracy of this code was checked by comparing with the NIST XCOM calculation [2]. It is confirmed that both data are equal, and the code calculation is reliable for practical use.

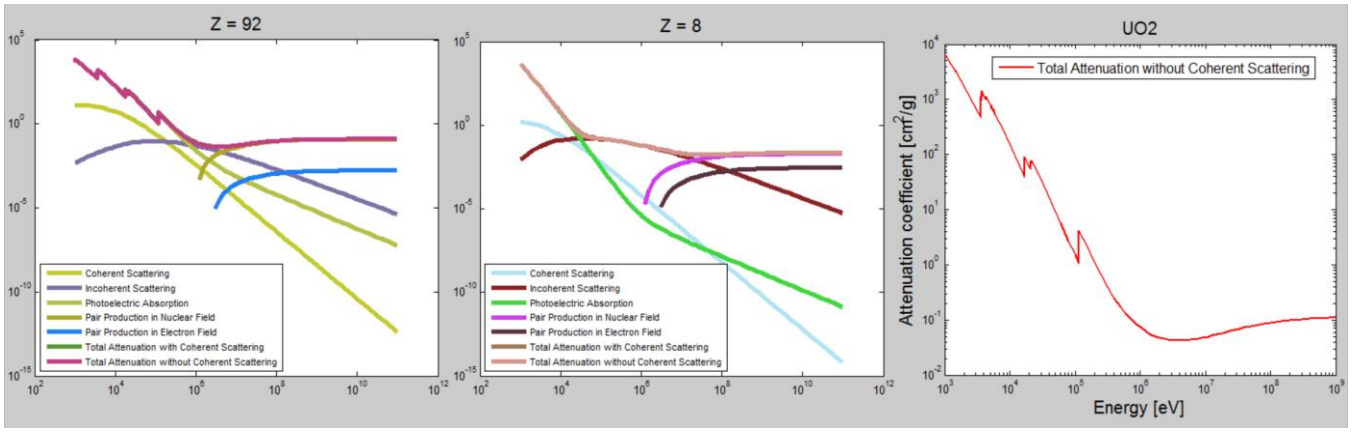

Fig.1. The calculated attenuation coefficient of UO_2. The first and second graphs are results for each element of the compound and the graph of the third is result for the compound.

REFERENCES

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