Computation of Neutron Coefficients for B$_2$O$_3$ reinforced Composite

Bekir ORUNCAK*

Afyonkocatepe University, Afyonkarahisar-Turkey

* Corresponding Author : Email: boruncak@aku.edu.tr - ORCID: 0000-0001-9823-5665

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Abstract:

Radiation is an important phenome and is used in different area since its discovery. Although there are different types of radiation, neutron is one of the most interesting types as it is an uncharged particle. This character made neutron is more dangerous radiation types than others and thus protection from neutron effect requires more care. In this paper neutron attenuation coefficients of B$_2$O$_3$ reinforced composite have been investigated using Phy-X/PSD software.

\[ \Sigma_R = \sum_i \rho_i \left( \frac{\Sigma_{i}}{\rho} \right) \]  \hspace{1cm} (2)

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2. Materials and Methods

The neutron attenuation coefficients are obtained in terms of FNRCs. The materials used for this work is Al$_2$O$_3$ composite where B$_2$O$_3$ were used in different rate of 45, 50, 55, 60, 65, 70 (mol%). The addition of B2O3 in composite is to see whether it is possible to increase neutron shielding properties. When B$_2$O$_3$ rate is changed in composite the Average molecular weight (g/mol) of composite and thus density for composite changed. These results were shown in Figure 1 and Figure 2 respectively where it is seen that both quantities have been increased linearly with the increasing B$_2$O$_3$ rate in composite. The parameters have been obtained for six different types materials using Phy-X/PSD online code which is a free online platform [37].

3. Results and Discussions

The calculations result of FNRCs of six different types of composites where B$_2$O$_3$ have been used, are shown Fig. 3 where it is seen that the FNRCs increased with the increasing B$_2$O$_3$ rate. This is
interesting and expected results as boron is well known element for neutron absorption. The relation between Neutron attenuation coefficients and Average molecular weight is displayed in Fig. 4 where it is clearly seen that over 97% correlation has been obtained between two parameters.

![Figure 1](image1.png)

*Figure 1. Average molecular weight (g/mol) as a function of B₂O₃ rate in composite*

![Figure 2](image2.png)

*Figure 2. Correlation between B₂O₂ rate and density of composite materials*

![Figure 3](image3.png)

*Figure 3. The FNRCS as a function of B₂O₃ rate in composite*

![Figure 4](image4.png)

*Figure 4. Correlation between Neutron attenuation coefficients and Average molecular weight*

**Author Statements:**

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The author declares that there is NO known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.
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**References**


