Contribution ID: **475** Type: **Oral**

Gamma-absorption properties of muscovite, beryllium and carbon based materials and their influnce in a modified geometry of transmission Mössbauer spectroscopy

In this work several proposed heat resistant materials were studied for the development of slit windows for reaction chambers in Mössbauer spectroscopy (MS). The material separating the sample section from the source and detector sections is required to have low absorption coefficient. Therefore their gamma-absorption properties were studied by MCA measurements using a common Mössbauer source of gamma radiation (57Co). Standard Mössbauer measurements were performed to determine any MS active contaminants presence that might influence the final spectra. High temperature annealing in air atmosphere of 1 bar pressure was carried out in for determining if the materials undergo any form of thermal decomposition or transformation. Such annealed samples were then studied with MS to establish thermal stability of their chemical composition. Effects of prolong and repeated exposure to these conditions were discussed in detail. Based on the observations, reusability and application potential of aforementioned materials are determined. The influence of modified measurement geometry on transmission Mössbauer spectrometer was established.

Summary

Four materials were chosen for observation - pyrolytic graphite, vitreous carbon, muscovite mica and beryllium. Their gamma-absorption properties were studied using MCA measurements with a standard Mössbauer source of gamma radiation (57Co). In addition, standard Mössbauer measurements were performed to determine presence of any iron impurities. High temperature annealing combined with MS measurements were carried for establishing thermal stability of chemical composition of aforementioned samples. The influence of modified measurement geometry of transmission Mössbauer spectrometer was determined.

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Track Classification: Experimental Nuclear Physics