Studying the Effects of Electron Beam Irradiation on Thermal Properties and Particle Size Distribution of Magnesium Hydroxide

13 – 16 July 2020
BINP, Novosibirsk, Russia

Nguyen Thi Van Anh, Boris Tolochko, Marat Sharafutdinov, Mikhail Mikhailenko, K.B. Gerasimov

INTRODUCTION

Because of its high thermal stability, magnesium hydroxide is widely used in various industries as a flame retardant in the production of thermoplastics and polymer composites materials. Using high energy electron beam to modify magnesium hydroxide is a perspective approach for the demand of enhancing the predominant properties of this material.

The influence of high energy electron beam irradiation on thermal properties, as well as the influence of different irradiation doses on particle size distribution of studied magnesium hydroxide were investigated. The changes of thermal behaviors and particle size distribution of studied sample were analyzed by using thermogravimetric analysis/ differential scanning calorimetry and image analysis, respectively.

RESULTS

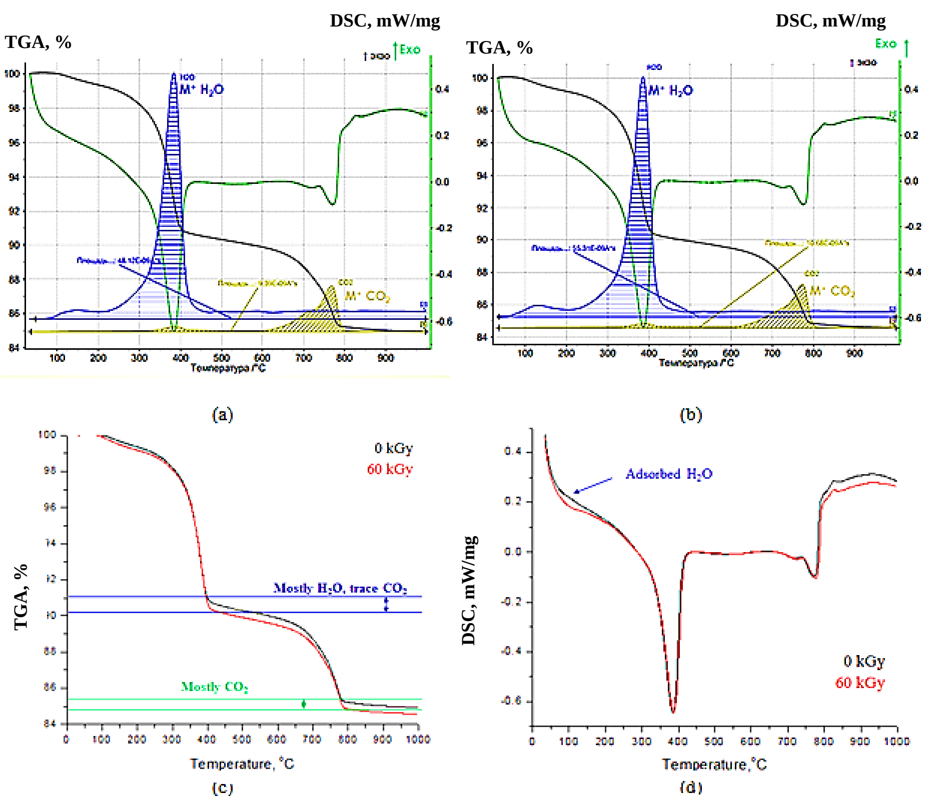

FIGURE 1. TG/ DSC/ MS curves of the sample: (a) before irradiation; (b) after irradiation ; (c) TG curves before/ after irradiation; (d) DSC curves before/ after irradiation

CONCLUSION

1 – The initial temperature of mass loss of the irradiated magnesium hydroxide is lower than that of the sample without irradiation;

2 – The quantities of released water and carbon dioxide gas of irradiated specimen are also higher than these values of non-irradiated one;

3 – The endothermic effects of decomposition reaction of irradiated sample are stronger than that of the sample without irradiation;

4 – The particle size of the sample becomes smaller after being irradiated

These results are positive and greatly important, especially in studying polymer composite materials using magnesium hydroxide as a flame retardant. All results indicate that high energy electron beam irradiation significantly improves the flame-retardant properties of studied magnesium hydroxide.

METHODS

Thermal decomposition behaviors were determined under conditions of inert atmospheres at a heating rate of 10°C/ min from 35°C to 1000°C and the irradiation dose of 60 kGy.

SR-XRPD was performed in the temperature range from 60°C to 600°C at a heating rate of 10°C/ min.

PSD measurement of the studied specimen was carried out at the different irradiation doses of 0, 20, 40, 60 and 120 kGy.

TABLE 1. TG temperature data of $T_{ini.}$ and T_{max}

	0 kGy	60 kGy
$T_{ini.}$, ^0C	104,986	88,714
$T_{max.}$, ^0C	383,5	383,714

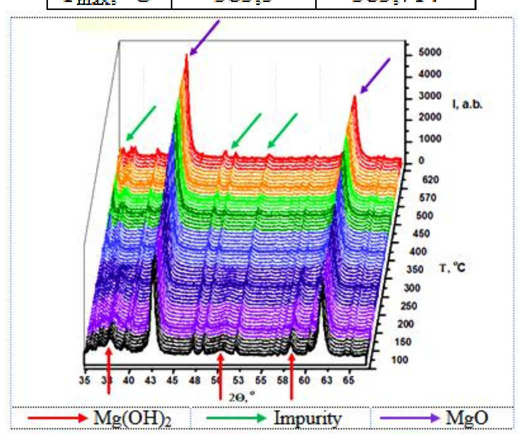

FIGURE 2 – SR-XRPD diffractograms of initial $Mg(OH)_2$ during heating

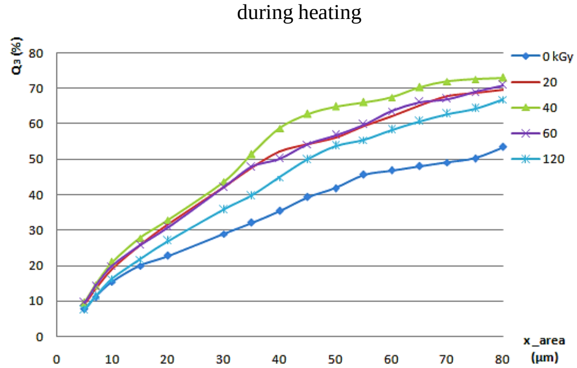

FIGURE 3 – The particle size distribution curves