

INFLUENCE OF GRAPHITE ADDITIVES ON THE SWELLING OF REACTIVE TYPE FIRE PROTECTION COATINGS

Vakhitov R. A.¹, Sholohon V. I.², Taran N. A.², Kalafat K. V.²

¹Kyiv National University of Technology and Design, Kyiv, Ukraine

²L. M. Litvynenko Institute of Physical and Organic Chemistry and Coal Chemistry of the National Academy of Sciences of Ukraine, Kyiv, Ukraine
vahitov89@gmail.com

The purpose of the study is to determine the effect of graphite fillers (expandable graphite (EG) and swollen graphite (SG)) on the swelling efficiency of intumescent coatings: volume coefficient of swelling (K) and mass loss (Δm). The study is aimed at optimising reactive fire retardant systems composed of ammonium polyphosphate (APP)/ melamine (MA)/ pentaerythritol (PE)/ TiO_2 / ethylene vinyl acetate (EVA).

The object of study is intumescent coatings applied to a metal surface and a fibreglass mesh. Composition variations include changing the amount of APP, EG, SG and titanium dioxide, as well as their combinations in the system.

Ammonium polyphosphate is one of the most important components of intumescent coatings, as its presence significantly increases the flame retardant properties of the system. For example, the coating (EVA/EG/APP) has a K of 34–36 cm^3/g and a Δm of 43–45 %, which is significantly higher than that of the system without APP ($K = 9\text{--}10 \text{ cm}^3/\text{g}$, $\Delta m = 65\text{--}67 \%$).

The addition of TiO_2 to the EVA/EG/APP composition reduces the coefficient of swelling but increases the char residue, which can be useful for increasing the strength of the carbon layer. The addition of EG or SG in the range of 0–20 % has a low effect on K and Δm at 400 °C, but increasing the EG content to 25–30 % increases the swelling intensity but at the same time makes the char residue less stable, which can negatively affect the adhesion of the coating to the surface (Fig.)

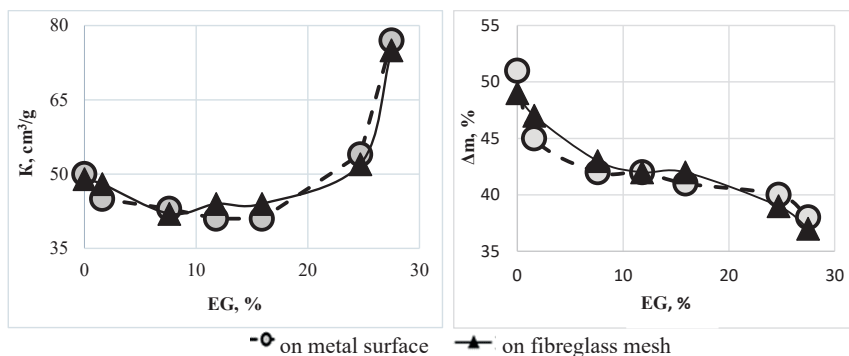


Fig. Values of the volume swelling coefficient (K , cm^3/g) and mass loss (%) of intumescent compositions when varying the amount of expandable graphite (EG, %), 400 °C

Changing the ratio of EG to SG does not provide significant advantages in improving the fire protection properties.

Thus, it was found that the use of EG in the amount of up to 20 % has a slight effect on the parameters K and Δm , which indicates the expediency of combining it with other components to achieve optimal characteristics of the intumescent coating. The study confirmed the importance of the presence of ammonium polyphosphate in the composition of intumescent systems and also showed the limited effectiveness of graphite fillers at high concentrations.