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Core-shell expandable graphite @ aluminum hydroxide as a flame-retardant for rigid polyurethane foams

Yintao Wang^{a,b}, Feng Wang^{b,*}, Quanyao Dong^c, Mingchen Xie^b, Peng Liu^b, Yanfen Ding^b, Shimin

Zhang^b, Mingshu Yang^{b,*}, Guoqiang Zheng^{a,*}

a. School of material science and engineering, Zhengzhou University, Zhengzhou 450001, China

b. Beijing National Laboratory for Molecular Sciences, Key Laboratory of Engineering Plastics, Institute of Chemistry, Chinese Academy of Sciences, Beijing 100190, China.

c. Railway Engineering Research Institute, China Academy of Railway Sciences, Beijing 100081, China

Abstract: To enhance the flame-retardant performance of expandable graphite (EG) in rigid polyurethane foam (RPUF), EG particles were encapsulated with inorganic nanoparticles, namely aluminum hydroxide (ATH), forming complex particles EG@ATH with core-shell structure. After the deposition of ATH shell, the expandability of the particles was enhanced from 163 to 197 ml/g, leading to better flame-retardant performance in RPUF. At a content of 11.5 wt%, the limited oxygen index could be increased from 21.5 % to 29.6 % by EG@ATH, in comparison to 27.5% by the physical mixture of EG and ATH (EG+ATH). Besides, EG@ATH exhibited better performance than EG+ATH on reducing the total smoke release and CO production. It is worth noticing that ATH could react with isocyanate groups, which was confirmed through FTIR. As a result, the interaction between the core-shell particles and the polymer matrix was enhanced, which protected the cell structure of RPUF from destroying by EG particles. The improved flame-retardant performance of EG@ATH, together with their low-cost, easy fabrication and especially friendliness to the environment, make it prospective in applications for flame retardancy of RPUF.

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