

Enhancement on fireproof performance of construction coatings using
calcium sulfate whiskers prepared from wastewater

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Abstract

This work is dealing with the fireproof performance of gypsum composite painting for fire passive protection in building construction. An efficient microwave-assisted method is adopted to fabricate high-crystalline $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ whiskers from wastewater. The as-prepared $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ whiskers display one-dimensional structure with a high aspect ratio of 40. The thermal resistive behavior of CaSO_4 -containing paints is investigated using thermo-gravimetric analyzer, differential scanning calorimetry, and direct flaming test (at 150, 570, and 1100 °C). The addition of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ whiskers not only improves the anti-flammability but also reduces the ignition temperature of construction painting. This result can be attributed to the fact that the heat transfer through the CaSO_4 -containing painting can be alleviated until the endothermic reaction steps [i.e., dehydration of gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) and crystalline phase change of β -hemihydrated plaster] are totally completed. The burned fractions (including pyrogenation and carbonization) on CaSiO_3 substrate are decreasing functions of the content of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ whiskers, proving that gypsum works as an insulator against heat transfer and flame spreading. Accordingly, the $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ whiskers can be considered as an effective fire retardant additive for improving the fireproof ability of construction coatings.

Keyword : Fireproofing Flame retardancy Calcium sulfate whiskers
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