# Penelitian pengaruh zat tahan api berbasis halogen terhadap sifat mampu bakar dari komposit serat karbon menggunakan kalorimeter kerucut = Study of the effects of halogen based fire retardant on the flammability of carbon fiber reinforced epoxy acrylate composite using cone calorimeter/ Muhammad Andira Mulia Siregar

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Abstrak

ABSTRAK<br>Dewasa ini, material komposit banyak digunakan dalam berbagai aplikasi karena memiliki sifat mekanik yang lebih bagus dari pada logam, memiliki kekuatan pembentukan yang tinggi, memiliki ketahanan yang baik, memiliki kekuatan jenis dan kekakuan jenis (modulus Young) yang lebih tinggi daripada logam. Namun demikian, material komposit rentan terhadap degradasi termal pada temperatur tinggi. Oleh karena itu, penelitian dalam tesis ini bertujuan untuk meningkatkan ketahan termal dan sifat mampu bakar material komposit dengan mencampurkan zat tahan api berbasis halogen jenis brominated bisphenol A ke dalam material komposit serat karbon dengan dua variasi densitas serat, yaitu 200 dan 240 gr/m2. Penelitian yang dilakukan berbasis pada eksperimen skala laboratorium menggunakan kalorimeter kerucut. Fenomena pembakaran yang terjadi adalah piloted ignition dengan fluks kalor pembakaran dibatasi sampai dengan 25 kW/m2. Hasil penelitian menunjukkan bahwa sampel komposit serat karbon terbakar karena vaporisasi dari resinnya, sedangkan serat karbonnya sendiri hanya mengalami pengarangan (charring). Eksperimen pada fluks kalor 21,12 kW/m2, menunjukkan bahwa kebeadaan kandungan brominated bisphenol A di dalam sampel komposit serat karbon mampu menekan puncak laju produksi kalor dari sekitar 125 kW/m2 menjadi hanya sekitar 80 kW/m2. Hasil penelitian juga menunjukkan bahwa kandungan zat tahan api (fire retardant) mampu menunda waktu penyalaan api pembakaran dan memberikan ketahana termal yang lebih baik kepada material komposit
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ABSTRACT<br>
Nowadays, carbon fiber reinforced epoxy-acrylate composite (CFRE) is used in various applications such as in aircraft and industrial applications including pressure vessels, civil engineering/construction-related uses, ship manufacturing, and automobile. That is because of its characteristics such as lightweight and high-strength. Nevertheless CFRE is very easy to be burned after preheating in a low heat flux, moreover with the presence of an external energy source. Hence, this study aimed to find out the effects of brominated bisphenol A as fire retardant agent on fire retardancy of CFRE using cone calorimeter with a spark igniter as a trigger to represent an amount of external energy source. Carbon fibers used in this study have density of 200 gr/m2 and 240 gr/m2. The parameter studied in this research includes density of carbon fiber, time to ignition, heat release rate and density of smoke production. In this initial work, the heat flux was limited up to 25 kW/m2 with piloted ignition. The measured temperatures of CFRE’s ignition range from 450oC to 575oC at atmospheric pressure. The initial result shows that the ignition of CFRE is strongly depend on the density of carbon fiber, the existing of an external energy source and the condition of gas mixture. For the density of of 200 gr/m2, CFRE starts to ignite under heat flux of 14.2 kW/m2 with peak heat release rate of 163.4 kW/m2. While for the density of of 240 gr/m2, CFRE starts to ignite under heat flux of 16.7 kW/m2

with peak heat release rate of 98 kW/m2. Combustion mechanism of CFRE started when a spark igniter is turned on after preheating at a certain sufficient heat flux, causing a flaming condition on the surface of CFRE. Next, vaporization of its resin causing a sustain flaming condition until reaching a decay period. When it burned, the resin vapor is forced out of the fiber pores, causing the material to swell and increased its volume. The effects of brominated bisphenol A as fire retardant agent in the CFRE give a significant impact to fire retardancy of the CFRE, especially in time to ignition and heat release rate aspect.