Analysis of Temperature Field Change of Composite Materials During Heating Process

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Abstract. The finite element software FLUENT is used to analyze the influence of the thermal coffecient of polymer resin on the thermal property of composites reinforced by nanopaper. Temperature cloudy maps under different thermal coefficient of polymer resin along the section z=0 during heating process have been analyzed. The research shows the greater the thermal conductivity of the polymer is, the higher the minimum temperature within the cross section, with the higher temperature. As the heating is carried out, the overall temperature rises obviously, and the heat is gradually transmitted to the polymer part through the area of the nanoscale heating sheet, and the heat exchange with the outer space is accompanied by the heat.

1. Introduction

Carbon nanotubes (CNTs) have excellent mechanical, electrical and thermal conductivity [1,2]. The thermal conductivity of multi-walled CNTs (MWCNTs) vary from 1400 W/(m•K) to 3000 W/(m•K) [3]. The thermal conductivity of single-walled CNTs (SWCNTs) have even higher thermal conductivity values [4] more than 6000 W/(m•K) [5]. CNTs nanopaper are self-supporting networks of entangled CNTs assemblies arranged in a random fashion [6].

The finite element software FLUENT is used to analyze the influence of the thermal coefficient of polymer resin on the thermal property of composites reinforced by nanopaper.

2. Results and discussion

Figure 1 shows the temperature cloudy maps under different thermal coffecient of polymer resin along the section z=0 during heating process. The thermal conductivity of four temperature distributions in each time is 0.1 W/(m•K), 0.15 W/(m•K), 0.2 W/(m•K), 0.25 W/(m•K) respectively.

As shown in Figure 1, the greater the thermal conductivity of the polymer is, the higher the minimum temperature within the cross section, with the higher temperature. As the heating is carried out, the overall temperature rises obviously, and the heat is gradually transmitted to the polymer part through the area of the nanoscale heating sheet, and the heat exchange with the outer space is accompanied by the heat.

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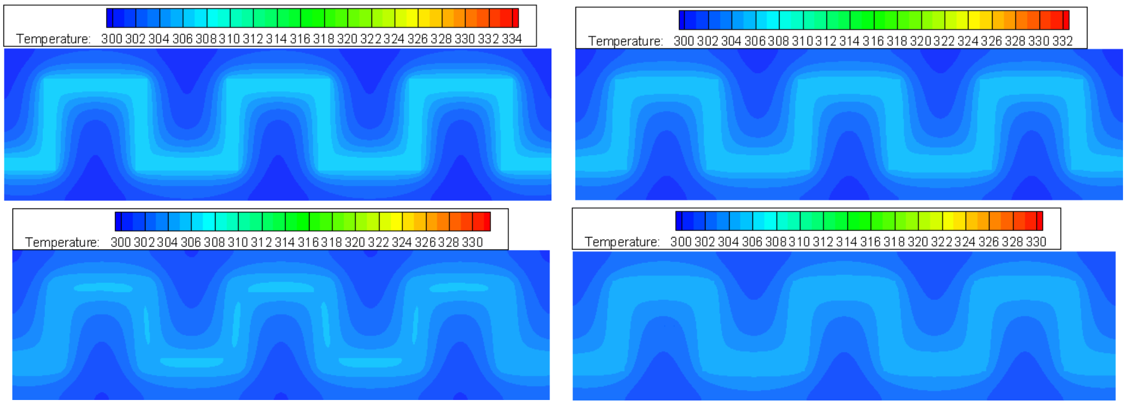

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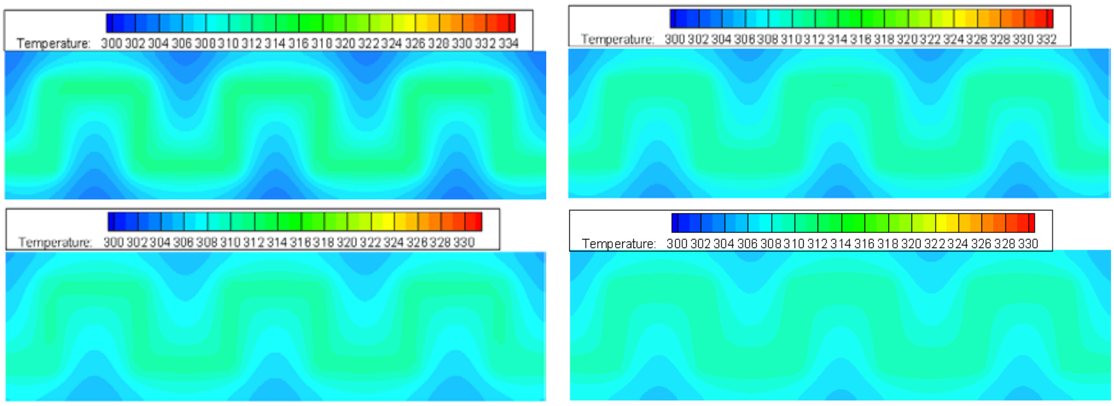

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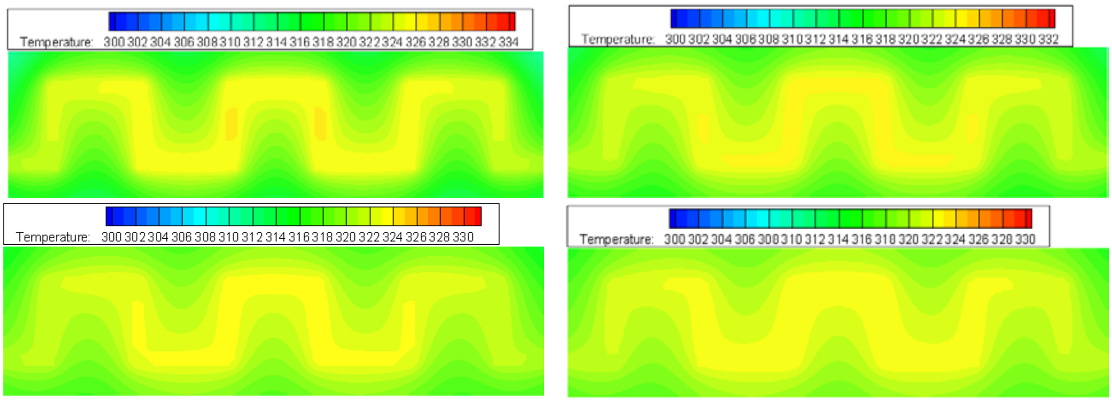

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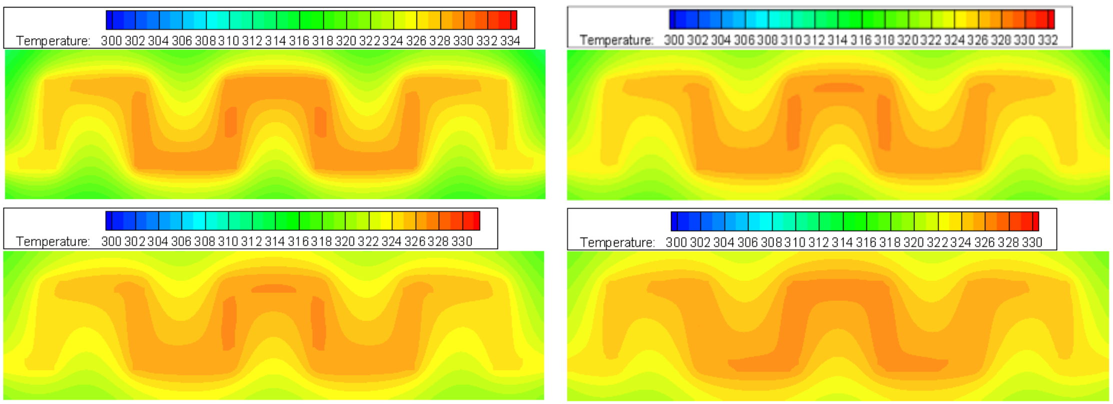
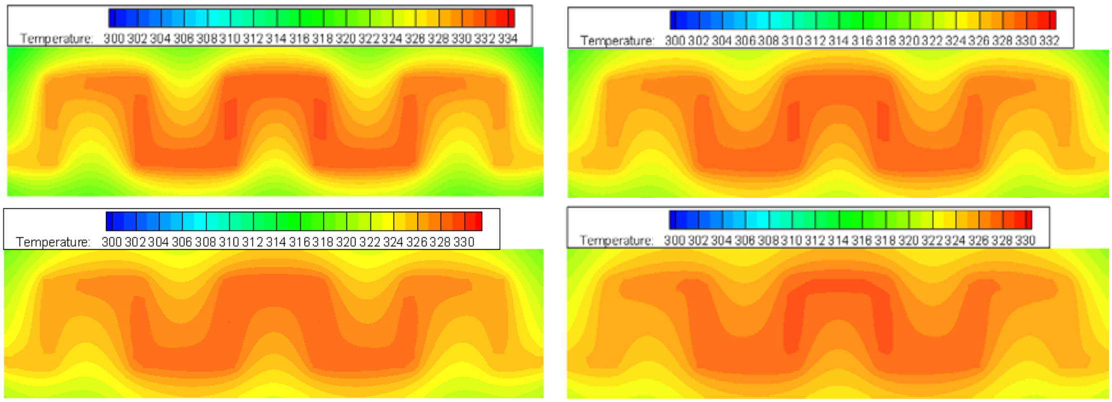
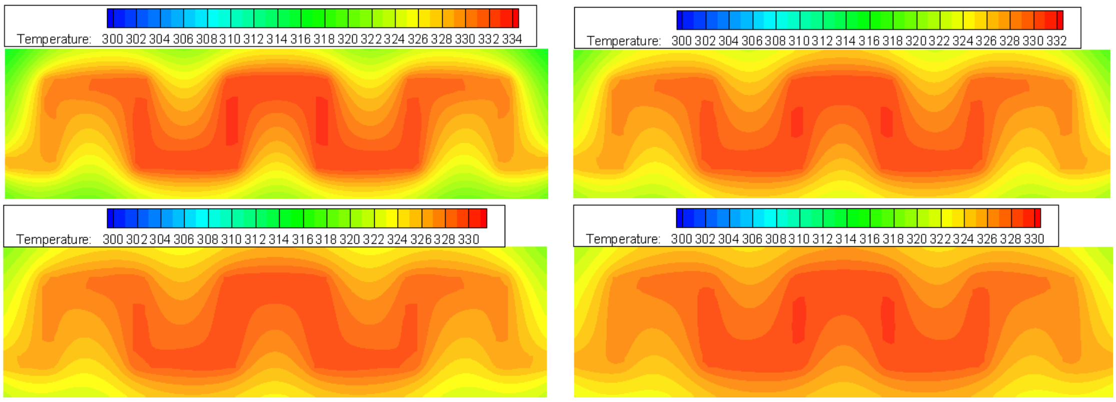


(d) 360s



(e) 480s



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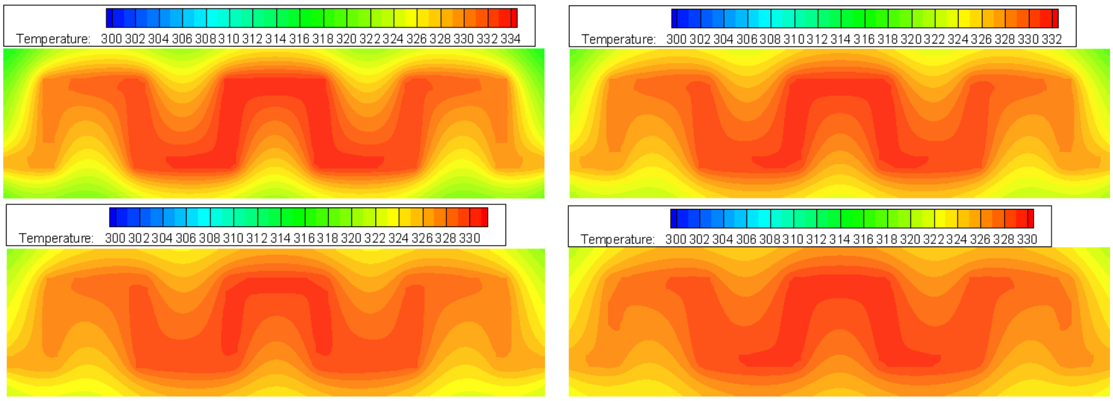
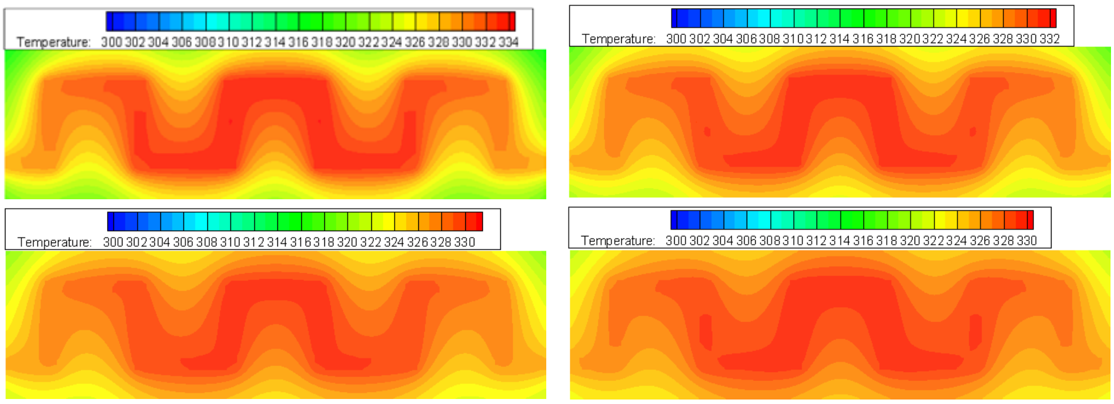
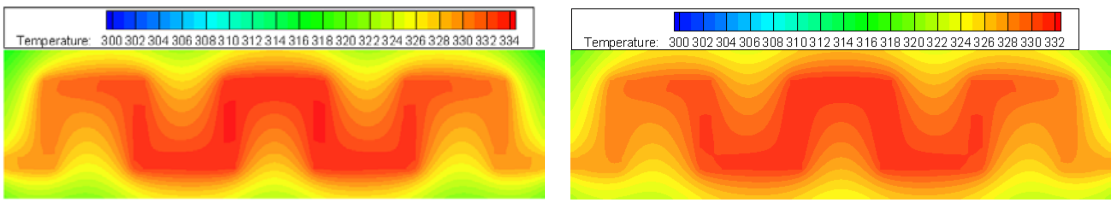
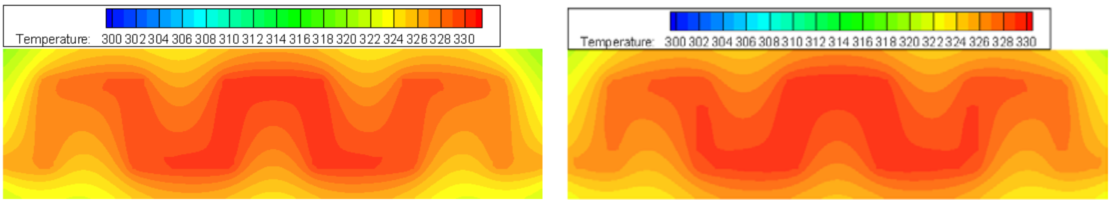


(g) 720s



(h) 840s





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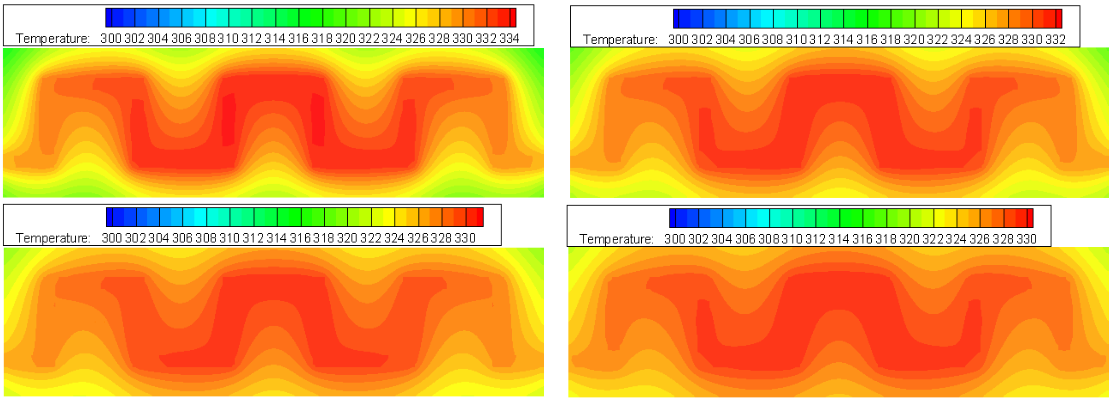

(j) 1100s

Fig. 1. Temperature distribution of composites with pulse bending nanopaper under different thermal coffecient of polymer resin along the section z=0

3. Summary

The finite element software FLUENT is used to analyze the influence of the thermal coefficient of polymer resin on the thermal property of composites reinforced by nanopaper. Temperature cloudy maps under different thermal coefficient of polymer resin along the section z=0 during heating process have been analyzed. The research shows the greater the thermal conductivity of the polymer is, the higher the minimum temperature within the cross section, with the higher temperature. As the heating is carried out, the overall temperature rises obviously, and the heat is gradually transmitted to the polymer part through the area of the nanoscale heating sheet, and the heat exchange with the outer space is accompanied by the heat.

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