SESSION 6: LIGHT ALLOYS, MARITIME HALL

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Simulation investigation of temperature distribution in large aluminium panel during autoclave age forming process

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ABSTRACT

In the autoclave age forming process, temperature distribution in large aluminum panel is one of the most important factors affecting its final shape and performance. A 3D computational fluid dynamics (CFD) model for autoclave processing of a large aluminum panel with the dimension of 2500 mm × 1300 mm × 17 mm is developed and experimental evaluated. The results, expressed as root mean square error (RMSE), show that a good fitting between the experimental data and the calculated results is obtained. The magnitude of RMSE for panel, mold and fluid are 5.68, 6.38, and 11.03°C, respectively. This confirmed that the proposed CFD model can be usefully applied for the prediction of panel's temperature distribution. Then, the temperature distribution in the studied panel during autoclave age forming process is investigated based on the numerical results. The slowest heating point (SHP) was positioned at the intermediate positions between 15 and 40% and between 55 and 70% of the panel length (about 30% volume fraction of panel). Due to the thermal conduction between panel and mold, the time to reach the peak temperature difference of panel was delayed by 0.2 h, though analyzing the temperature field of panel can provide guidance for mold design and processing parameters optimization.