ECCM18
European conference on composite materials
24-28 June 2018 - ATHENS, GREECE

Simulation of laser heating of thermoplastic composite in an automated placement process using ray tracing method

O. Baho, J. Férec and G. Ausias

Institut de Recherche Dupuy de Lôme (IRDL), Univ. Bretagne Sud, FRE CNRS 3744, IRDL, F-56100 Lorient, France

Continuous fibre reinforced thermoplastic polymer composites exhibit superior properties like mechanical performance, recyclability and the potential for light-weight structures. These composites are used in a wide range of high-performance structure applications nowadays, and high-quality parts are produced thanks to improvements in processing technology. For instance, the Automated Fibre Placement (AFP) allows manufacturing composite materials out of autoclave. Generally, AFP lays the prepreg material over a substrate with a robotic placement head. The surfaces of both the tape and the substrate are heated, whereas a roller presses the molten surfaces at the same time in order to consolidate the prepreg as shown in fig.1. The consolidation quality depends on the material's thermal history before the contact. That is why it is necessary to know the power distribution reaching both surfaces to evaluate the total energy absorption.

This paper investigates the energy quantity absorbed by the Polyether ketone reinforced with carbon fibres (APC-2) with a ray tracing method. During the simulation process, the illuminated material's radiative properties are characterised and evaluated in terms of the angle of incidence, the wave length, and the deformation of the roller. After computing the radiative source term, these data are used to calculate the temperature distribution on the surface and through the thickness of composite by using the commercial finite element method software.

The NHYTE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723309.

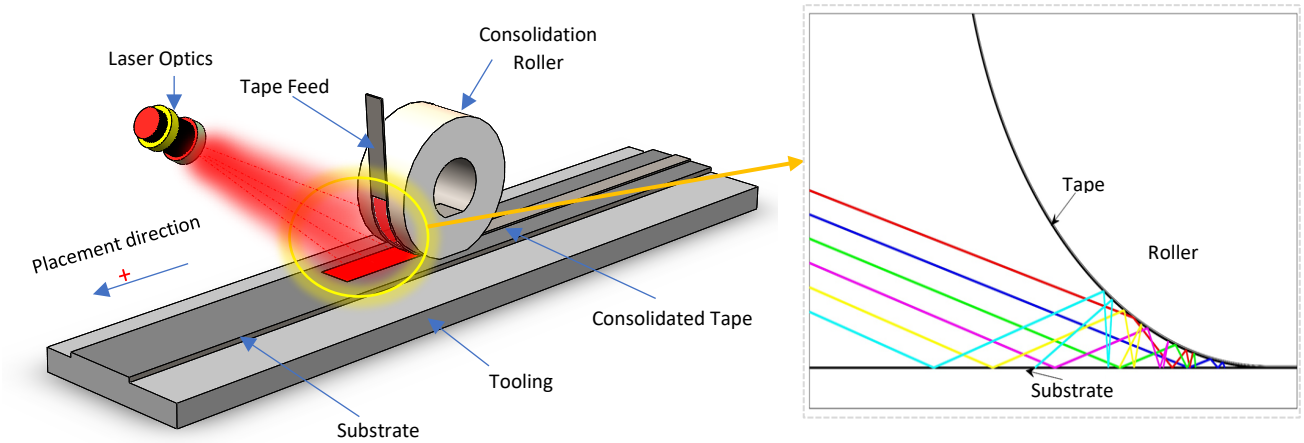

Fig.1. Principle of an AFP process with visualisation of laser reflections on the tape and on the substrate.