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Abstract: The scattering effect of laser-transparent part has significant influence on the intensity profile of heat source during laser transmission welding (LTW). The purpose of the present study is to propose a method for modeling the laser heat source considering light scattering. The knife-edge experiment is served to obtain the normalized power flux distribution (NPFD) without considering light scattering, and the non-contact line scanning experiment is used to describe the NPFD considering light scattering. Subsequently, the energy transformation algorithm is presented to transform the normalized line energy intensity into the normalized point energy intensity. Then the heat source considering light scattering can be modeled based on the distribution of point energy intensity. Compared with the heat source without considering light scattering, the intensity profile of heat source considering light scattering shows a wider width and a lower peak height. Especially when the laser-transparent part contains reinforcements, the difference of intensity profile is more evident than the unreinforced laser-transparent part. This indicates that light scattering has a significant influence on the laser intensity at the weld interface. The proposed method for modeling the heat source, considering light scattering, can optimize the laser source in the numerical simulation of LTW.

Keywords: Laser transmission welding; Light scattering; Laser beam profile; Energy transformation algorithm; Heat source considering light scattering

1. Introduction

Laser transmission welding (LTW) is a technique increasingly being used for joining laser-transparent and laser-absorbent thermoplastic materials [1–3]. Along

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