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Effect of heat treatment and initial thickness ratio on spin bonding of 3A21/5A03 composite tube

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Abstract

Composite tubes, which combine the advantageous properties of each layer, are in increasing demand in industry. The spin-bonding process shows great potential in producing composite tubes of dissimilar metals. In this study, the deformation synchronism index is proposed to describe the deformation uniformity between internal and external tube, which is defined as the ratio of difference in thickness reduction between external and internal tube to total thickness reduction. The process experiment and FE simulation are carried out to investigate the effect of heat treatment, initial thickness ratio and thickness reduction on bonding strength and deformation synchronism in spin-bonding of 3A21/5A03 composite tube. The results show that the deformation synchronism index decreased as the thickness ratio and yield stress ratio of internal tube to external tube reduced. The distribution of plastic strain was discontinuous across the interface of composite tube due to gradiently decreased stress field under the roller and different yield stresses between external and internal tube. The bonding strength increased at relatively smaller yield stress and greater thickness of internal tube. However, the maximum thickness reduction the composite tube could undertake before fracture was reduced when the external tube was thinner. This study is helpful for the design

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