The Shot Peen Forming of Fiber Metal Laminates based on the Aluminum-lithium Alloy

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Abstract: The feasibility research on shot peen forming of the novel fiber metal laminates based on aluminum-lithium alloy (NFMLs) was investigated to seek a desired forming method. Several typical forming processes were applied for NFMLs respectively using different ceramic and cast steel balls. Then, the failure behavior of shot peened NFMLs was mainly investigated by C-scan ultrasonic testing and scanning electron microscopy (SEM). Meanwhile, the surface roughness variation as well as the formed curvature was analyzed. The unique deformation behavior of the laminates comparing with monolithic materials was revealed. The results indicated that NFMLs had the feasibility to manufacture by shot peen forming. High shot peening intensity and large ball size usually caused the serious plastic deformation in the shot peened surface and evident stress variation in the metal/fiber interface, leading to interface delamination and fibers break. Moreover, the increased but quite uniform surface roughness was obtained for the shot peened laminates. Large size ball was beneficial to improve the surface quality when achieve the same shot peening intensity. Besides, the ball type and size significantly affected the formed curvature of NFMLs, because the fiber layer had complex effects on the formation behavior. Overall, the AZB425 ball was more beneficial to improve the surface quality and formed curvature, which also positively avoided the failure behavior of NFMLs. A minimal curvature radius was reached approximately 200mm within the investigated process.

Keywords: fiber metal laminates; aluminum-lithium alloy; shot peen forming; feasibility; failure behavior

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