Joining Efficiency in CFRP-Metal Hybrid Structure of Self-Piercing Riveted Joints for Automotive Applications

Dong-Hyuck Kam1, Geunho Kim2, Won Ho Choi3, Jun Hyuk Seo4 and Cheolhee Kim1

1Korea Institute of Industrial Technology

2AsaN Co., Ltd

3Top IND Co., Ltd

4Young Jin Co., Ltd

Carbon fiber reinforced plastic (CFRP) has been successfully introduced in automotive structural materials according to increasing competition in the electric and hybrid vehicle. CFRP is a super-eminently light-weight material in automotive industries and joining between CFRP and conventional metals is an issue raised drastically. Fusion welding between both materials is quite limited and mechanical joining are preferred in the industry.

Self-piercing rivet (SPR) has many advantages in joining sheets of dissimilar materials. It does not require a pre-drilled hole and can be theoretically applied in most materials combinations. However, SPR joining requires a joining system including a punch, a rivet and an upset die and also it needs several process parameters to be optimized.

In this study, CFRP/Al sheet combinations were selected as base materials and SPR joints were made with various combinations of a rivet and a forming die. Punching force was a process parameter controlled. Cross-sectional joint shapes were examined and failure loads in a tensile shear test was measured. Specific combination of a forming die and a rivet was recommended in CFRP/Al alloy joint and adequate process parameters were suggested for the material combinations.