

Friction Stir Welding (FSW) – Accelerating Automobile Industries

Dr K Elangovan

Head of Section (Mechanical Engineering), Ibri College of Technology, Ibri, Ministry of Man power, Sultanate of Oman
Email: k.elangovan@ibriect.edu.om

Engineering structures in transportation industries like automobile, rail road cars and marine vessels demands reduction in weight, efficient joining technique and economical way of manufacturing. To meet stringent fuel economy standards, automakers must dramatically reduce vehicle weight. As a result, engineers are using more and more aluminum for body panels, engine components and structural parts. Aluminum use in vehicles is expected to double by 2025, as automakers roll out a wide variety of lighter weight models. Aluminum is corrosion-resistant and offers an excellent blend of strength and low mass that can help improve fuel economy. Vehicles made with aluminum components can also accelerate faster and brake quicker than their heavier counterparts. Traditionally, aluminum vehicles have been assembled with structural adhesives and rivets. Because higher production volumes hinder adhesive use, automakers have relied on self-piercing rivets to join aluminum body parts. However, rivets add cost, and riveting guns have a limited range of joint configurations. And, while this approach can be used to join lower-strength steels with aluminum, it isn't suitable for joining aluminum to ultra-high-strength steel. Automakers and part suppliers are focusing on new ways to join aluminium with tools and technology other than traditional resistance spot welding, which is prone to variability. Now, the automotive industry is keen to use thinner sheets, in order to build lighter vehicles and reduce production costs. More and more car manufacturers choose a hybrid design, where a combination of different materials such as steel and aluminium are joined. With classic welding methods, joining of dissimilar materials has not been possible. With friction stir welding, on the other hand, high quality dissimilar joints can be obtained. The welding temperature is kept below the melting point, which means that the alloy properties are not destroyed and strong joints are achieved.

Increasing regulations on emission norms insist automobile manufacturers to reduce weight on structures by adopting new manufacturing techniques. Especially, in aerospace and transportation industries designers and manufacturers attempting new methods to replace conventional joining methods like GTAW, GMAW and riveted joints.

Friction Stir welding (FSW) has emerged as new alternative joining technique to replace other joining methods and considered as most significant joining process in the past two decades. The number of applications of this technique in aviation, automobile and other industries is growing exponentially owing to the high joint strength, energy efficient and eco friendliness. The reason for higher joint efficiency is due to process physics involved in the weld region. Unlike fusion welding techniques, no heat is added to the system; instead heat is generated internally by means of friction between the tool and the work material interface results in plastic deformation and subsequent forging ensures the joint. The frictional heating in welding eliminates fumes, gases and arc glare avoid welding fume toxicity make the process as one of the eco-friendly manufacturing processes. Due to low distortion, higher joint efficiency and process speeds FSW emerged as eco-friendly process and associated impact on emissions by reduction in weight on aero and automobile structures. Friction stir welding will no doubt begin to overtake traditional means of

welding in ever manufacturing industry over the next decade, just as it did in the aerospace world. We're excited to see how this burgeoning new way to bond materials becomes the new standard. And unlike conventional welding, which adds mass in the form of filler metal from welding wire, FSW adds nothing. So it reduces the weight of the finished product at a time when every gram counts in today's fuel-economy-driven industry. Given this, and the ability to weld dissimilar metals, friction stir welding opens up more opportunities to use aluminum and aluminium steel dissimilar combination to trim weight. Expect to start seeing FSW everywhere in the automotive sphere.