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## Potential application of friction welding of tube to tube sheet using an external tool process in automobile fabrication

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Friction welding of tube to tube plate process using an external tool (FWTPET) was invented by the author of this article and a patent was granted in the year 2007. The process is solid state welding process and successful joints have been achieved in the base materials including dissimilar alloys of aluminum, copper, stainless steel, boiler grade steel, titanium and polymers. The advantages of FWTPET process include capability of dissimilar metal welding, energy efficient, green manufacturing, fast, better mechanical properties, less metallurgical issues, high quality, easy to automate and economical. In general the material used to construct vehicle chassis and frames is carbon steel or aluminum alloys to achieve a more light-weight construction. Welding of similar and dissimilar metals is a great challenge in replacing steel with aluminum and using of different materials. FWTPET is having a good potential applications in automobile fabrication including vehicle chassis and frames. In the present article gives the principle of FWTPET and metal flow phenomena are explained. The tools, fixtures and machinery used to achieve FWTPET are discussed. An overview of similar and dissimilar welding achieved by FWTPET process has been given.

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