ABSTRACT

An approach to reduce manufacturing cost, weight, design and improve quality of a component is through the use of tailor welded blanks (TWBs). TWBs are welded blanks that consist of similar or dissimilar material, thicknesses, and surface properties before forming process. The purpose of the project is to evaluate the strength and fatigue behavior of the TWBs with different thickness combination and loading direction. The welding process was done by tungsten inert gas (TIG) arc welding. This study is divided into three parts. First, tensile tests were carried out. It was found that combinations were affected by the difference in thickness (2 mm/3 mm) and weld orientation (45^o and 90^o towards loading direction). The failure occurred in the middle of the weaker base metal parts. However, some of the joint specimens broke at the heat-affected zone. In addition, weld loading direction played a dominant role when the thickness difference was large. The second part investigates the effect of welding joint on the fatigue strength of the TWBs combination. The experimental results show that the failure occurs at welding zone as the specimens were subjected to fatigue and impact loading. In the last part of this thesis, the examination of the weld quality was carried out. Through the microstructure constituents in the weld, the strength and effects on the TWBs were discussed.

ABSTRAK

Sebuah pendekatan dalam mengurangkan kadar kos pengeluaran, berat, reka bentuk dan peningkatan kualiti dalam sebuah komponen ialah melalui penggunaan *tailor welded blanks (TWBs*). *TWB* merupakan kimpalan kosong yang melibatkan penggunaan bahan yang sama atau berlainan, beza ketebalan dan sifat-sifat pada permukaan sebelum proses membentuk. Tujuan projek ini dilaksanakan ialah untuk menilai kekuatan dan sifat kelesuan kimpalan kosong yang terdiri daripada ketebalan yang berbeza dan arah beban. Proses kimpalan dilakukan dengan mengguna *gas tungsten arc welding(GTAW)*. Kajian ini merangkumi tiga bahagian. Pertama sekali, ujian tegangan dijalankan. Kajian ini mendapati sambungan *TWBs* dijejaskan oleh perbezaan ketebalan (2 mm/3 mm) serta orientasi semasa mengimpal (45^o dan 90^o ke arah beban). Kegagalan berlaku di bahagian tengah logam yang lemah. Namun, sesetengah sambungan kimpalan patah di *heat affected zone* (*HAZ*). Selain itu, arah beban memainkan peranan yang dominan apabila perbezaan ketebalan besar. Bahagian kedua tesis mengkaji kesan sambungan *TWBs* terhadap kekuatan kelesuan. Ujian eksperimen menunjuk bahawa kegagalan berlaku di zon kimpalan di mana specimen tertakluk kepada keletihan dan kesan beban. Bahagian terakhir tesis ini ialah pemeriksaan kualiti kimpalan.Melalui pembentukan juzuk mikrostruktur yang terdapat di dalam kimpalan, kekuatan dan kesannya terhadap *TWBs* telah dibincangkan.