Pengembangan proses micro friction stir welding pada lembaran aluminium seri 1000 untuk struktur ringan = Development of micro friction stir welding process of aluminum a1000 sheet for light structure

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Abstrak

[ABSTRAK
Teknologi Friction stir welding (FSW) menjadi alternatif proses penyambungan aluminium yang relatif sederhana, bahkan dalam beberapa hal memiliki kelebihan jika dibanding dengan cara konvensional (misalnya: proses las, proses keling dsb.).

Proses FSW memerlukan mesin perkakas yang memiliki kekakuan terhadap gaya (aksial dan transversal) dan ketelitian gerak yang baik, agar mampu menahan gaya reaksi dalam proses FSW. Proses FSW untuk material lunak dan tipis tidak membutuhkan mesin perkakas yang kokoh, bahkan bisa menggunakan mesin freis (milling machine) atau mesin gurdi (drilling machine) dengan mengganti pahat (tools) dan parameter proses FSW yang sesuai.

Kebutuhan struktur ringan pada industri transportasi menjadi topik penelitian utama, dengan tujuan mengurangi berat struktur, tetapi tidak mengurangi kekuatan dan kualitas struktur. Kebutuhan informasi teknologi FSW untuk penyambungan plat tipis dan konstruksi ringan sangat dibutuhkan di industri. Proses penyambungan plat aluminium tipis (tebal < 1mm) dan untuk membatasi kerusakan akibat gaya dan panas berlebihan, membutuhkan teknologi dan peralatan khusus.

Tujuan penelitian ini adalah mengembangkan proses micro Friction Stir Welding (μFSW) dan meneliti hubungan parameter μFSW terhadap kualitas hasil las, dan mencari parameter optimum menggunakan metode Neural Network (NN) dan Genetic Algorithm (GA), serta pembuatan simulasi temperatur μFSW. Pada penelitian disertasi ini akan terbagi menjadi dua bagian yaitu, yang pertama adalah uji eksperimental dan pembuatan model matematik. Pada bagian kedua adalah penelitian aplikasi proses micro Friction Stir Welding pada pembuatan struktur ringan.

Diharapkan dengan penelitian disertasi ini akan; 1) mengetahui efek parameterparameter pengelasan terhadap respon dan kualitas pada micro Friction Stir Welding, dan 2) memberikan usulan metode pemilihan parameter yang optimum. Penelitian berhasil mendapatkan parameter proses μFSSW pada aluminium A1100 yang menghasilkan temperatur las lebih dari 460 oC (yaitu 0,8.Tm, Melting Temperature), merupakan batas temperatur minimal untuk menghasilkan kualitas sambungan las yang baik. Uji kualitas las dibuktikan dengan hasil uji mekanik dan struktur mikro. Parameter proses ini telah diterapkan pada proses penyambungan aluminium tipis untuk pembuatan struktur ringan honeycomb.
<hr><i>ABSTRACT
Friction Stir Welding is a relatively new technique for joining metal. In some cases on aluminum joining, FSW gives better results compared with the arc welding processes, including the quality of welds and

produces less distortion. Research on friction stir welding has been done, but data results are difficult to obtain by manufacturing engineers/workshop, unlike other process parameter data, for example: Milling process data, Turning process data, grinding process data. The ultimate goal of this research is to build a model and simulation process of micro Friction Stir Welding (μFSW), which is main parameters, the force that occurs, the quality of results and the mechanical properties of FSW welds.

Research will investigate the relationship between different parameters in FSW aluminum A1100, 0.4 mm thickness. The goal is to develop a mathematical model that establishes the relationship between multiple input and multiple outputs. As part of this research, will be investigated material changes in temperature, forces, torque and tool wear as a function of output parameters and explore their interactions. Experimental design (DoE) will be used and data analysis using Neural network Methodology and Genetic Algorithm.

Research found the optimum μFSSW parameters, which is weld temperature higher than 460 oC (mean 0,8.Tm, Melting Temperature). The welds qualities were measurred by shear load test, micro structure test, micro hardness test, and composition test. The optimum μFSSW parameters were applied to build the light structure honeycomb.</i>, Friction Stir Welding is a relatively new technique for joining metal. In some
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