DEVELOPMENT OF BORONIZED DUPLEX STAINLESS STEEL MINI GEAR THROUGH SUPERPLASTIC DEFORMATION

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DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ENGINEERING SCIENCE

FACULTY OF ENGINEERING
UNIVERSITY OF MALAYA
KUALA LUMPUR

2013

UNIVERSITY OF MALAYA

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ABSTRACT

In this work, formation of mini gear with superplastic deformation on boronized duplex stainless steel (DSS) was studied through the employment of these quantifying factors, i.e. strains and strain rates. As received DSS specimen was thermo-mechanically treated by heating up to 1537K, holding for one hour, followed by water quenching and then cold rolled to a plate through a reduction area of 75%. Boronizing process was carried out at 1223K for 6 hours, thereafter successfully created surface hardness of 2253HV and 40µm thickness of boronized layer on the DSS. The specimen was then superplastically deformed into a mini gear at 1223K. Result shows surface integrity of the boronized layer deformed at 6 x 10^{-5} s^{-1} strain rate and 0.4 mm/mm strain was maintained. As the study progressed, boronized layer demonstrated failure to withstand the increased load when deformed at 1x 10^{-4} s^{-1} strain rate. At 6 x 10^{-5} s^{-1} strain rate and 1.0 mm/mm strain, the surface disintegrity was associated to high strain factor.

ABSTRAK

Di dalam kerja ini, pembentukan gear mini dengan ubah bentuk superplastik ke atas keluli kalis karat terboron (DSS) telah dikaji dengan menggabungkan beberapa faktor pembolehubah iaitu terikan dan kadar terikan. Spesimen DSS yang diterima telah dirawat secara thermo-mekanikal dengan memanaskannya hingga ke 1537K, dibiar selama satu jam, diikuti dengan lindapkejut air dan dicanai dingin kepada kepingan dengan pengurangan sebanyak 75% dari luas asal. Proses pemboronan dilakukan pada 1223K selama 6 jam yang mana berjaya menghasilkan kekerasan permukaan sebanyak 2253 HV dan ketebalan lapisan terboron 40 μm di lapisan permukaan DSS. Spesimen kemudiannya diubah bentuk secara superplastik kepada gear mini pada 1223K. Keputusan menunjukkan integriti permukaan lapisan terboron yang diubah bentuk pada kadar terikan 6 x 10^{-5} s^{-1} dan terikan 0.4 mm/mm dapat di pertahankan. Dalam kajian ini, lapisan terboron gagal menahan peningkatan beban pada kadar terikan 1x 10^{-4} s^{-1}. Pada kadar terikan 6 x 10^{-5} s^{-1} dan terikan 1.0 mm/mm, disintegriti permukaan adalah berkaitan dari faktor terikan yang tinggi.

ACKNOWLEDGEMENT

Alhamdullillah. Thanks to Allah for giving me good health and mind that I was able to complete this research project. I would like to express my deepest appreciation to my supervisor, Dr. Iswadi Jauhari, for his inspirational enthusiasm, ideas and help in accomplishing this research. Appreciation is also extended to my research group Mazlan Shah, Rosnaini Saidan and staff of Mechanical Engineering Faculty and Mechanical Engineering Department, University of Malaya, especially En. Aziz for the supports rendered and ideas shared, it has been a great pleasure to work with you all. A special tribute to my mother Harisah@Fatimah bt. Omar, my father Ismail bin Abdul Rahman, my wife Rohazlina bt Abdul Kudus, my kids Ahmad Hafidz, NurHafiza, Ahmad Hakim, Nur Hadirah and Ahmad Haris for their love, patience, encouragement and faith in my competency. Deepest apologies to those I have overlooked, for without you all, this work would not have been successful.

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Faculty of Engineering

University of Malaya

2013

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