

DEVELOPMENT OF BORONIZED DUPLEX STAINLESS STEEL
MINI GEAR THROUGH SUPERPLASTIC DEFORMATION

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ORIGINAL LITERARY WORK DECLARATION

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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 40 μ m 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 $6 \times 10^{-5} \text{ s}^{-1}$ 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 $1 \times 10^{-4} \text{ s}^{-1}$ strain rate. At $6 \times 10^{-5} \text{ s}^{-1}$ 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, dibiarkan selama satu jam, diikuti dengan lindapkejut air dan dicanai dingin kepada kepingan dengan pengurangan sebanyak 75% dari luas asal. Proses pemborongan 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 $6 \times 10^{-5} \text{ s}^{-1}$ dan terikan 0.4 mm/mm dapat di pertahankan. Dalam kajian ini, lapisan terboron gagal menahan peningkatan beban pada kadar terikan $1 \times 10^{-4} \text{ s}^{-1}$. Pada kadar terikan $6 \times 10^{-5} \text{ s}^{-1}$ dan terikan 1.0 mm/mm, disintegriti permukaan adalah berkaitan dari faktor terikan yang tinggi.

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