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Investigate wear resistance of aluminium 2024 alloy by using pin on disc tribometer

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Abstract - *study of high purity aluminum alloy 2024 and to investigate the wear resistance during pin on disc tribometer. Experiments results obtain from different paper on solution treatment, change in microstructure of material, optical microscopy, Vickers hardness and rolling. The study of these experiments result in increase tensile strength, hardness and wear resistance.*

Key Words: Aluminium Alloy 2024, Solution Heat Treatment, Pin on Disc, Optical Microscopy, Rolling.

INTRODUCTION

A Tribometer is an instrument that measures tribological quantities such as friction force of these researchs are improvement of wear properties uses some techniques such as heat treatment, simple room temperature rolling, micro hardness, optical microscopy, XRD and pin on disc tribometer. This is a Tribometer with precise measuring wear properties of combination of metal. The material uses in these experiments are Al 2024 alloy. These experiments relates to behavior of material after heat treatment, room temperature rolling. Results and graphs of these experiments obtaining by Micro Hardness Test, Optical Microscopy, XRD Analysis and Pin On Disc Tribometer

LITERATURE REVIEW

Yoshinori Iwahashi [1997][1]. In this paper he checks the process of grain refinement during equal channel angular pressing. He examine in these mutually perpendicular direction samples were subjected to 1 to 4 pressing. The result depends upon whether these repetitive pressing are conducted with samples are not rotate [Route A], With 90° rotate [Route B], With 180° rotate [Route C]. The evaluation is slowest in Route A. The result are depends on patterns develop in the samples during each pressing route.

Y. Shito [1998][2]. In this experiment a novel intense plastic straining process named accumulative role bonding (ARB) is proposed. Firstly a strip is clean and neatly adjusts on the top of another strip. Two material plate or layer is joined together by rolling process. After the length of rolled material is cut into two halves. The cut into strip are again stacked and roll bonding. This process is repeated again and again. This process is ultra high plastic strain without any geometrical change. If the reduction of thickness to maintained to 50% every rolling process. Well bonded bulk materials were successful obtained. After many cycles of ARB ultra fine grain structure with large disorientation.

Yuntion Theodore Zhu [2000][3]. In this experiment he explains the rotation schemes between adjacent passes, significantly affects effectiveness of grain refinement. His previous work considered the accumulative strain and effect of shear strain plane in the observations. But they are not sufficiently each other in some cases. He analysis experimental results and investigate the fundamental mechanism of grain refinement and the accumulative strains play a secondary role.

Vladimir V. Stotyarov [2001][4]. ECAP is the most effective process for ultra fine grained materials. In this experiment billet passes in die during the iterative that makes better micro structure development the focused on FCC metals such as Aluminum and copper. He has influence of ECAP route. According to this paper route B is shown to be best route for processing HCP Ti.

R.S. Mishra [2001][5]. SPD processed Ti-6Al-4V alloy has been studied in temperature range 25-675°C. Compared the strength of the nano crystalline state material at 400°C. The ductility is higher for above 500°C, and super plastic above 600°C. The compare of super plastic data in nano Crystal and micro crystal range. The kinetics of super plastic deformation was slower in ultra fine grained material. Means result is that the nano crystalline is slower super plastic deformation.

A.P. Zhilyaer [2001][6]. This paper leads to orientation imagining microscopy used to measure the distribution of grain boundary in SPD. ECAP and HPT give high fractions of high angle boundaries but also higher fraction of low angle boundaries.

Minoru Furukawa [2002][7]. The micro structure of a metal may be very significantly changed through procedure such as ECAP and HPT, and the SPD leads to substantial refinement in grain size. The grains are reduced to typically. This experiment explains the application of SPD to pure Aluminum alloys. All SPD process the material subjected to ECAP are capable of exhibiting exceptional mechanical properties including super plastic ductility at very rapid strain rates. The result is described showing in super plastic forming application at high strain rates.

Georgy J. Raab [2004][8]. In this paper author report a new technique of SPD which combines ECAP and conform. Process of ultra fine materials in continues manners. The ECAP is short metal bars process and conforms is a process for continuously and various shapes. By combination of these two techniques are produces. He produces ultra fine grain in Aluminum and increases its strength.

M.T. Perez- Prado [2004][9]. Author used to accumulative roll bonding for increase the content of Mg Az in Aluminum from 3% to 9%. Finale grained size reached after the first pass. And the homogeneous micro structure increase with the no of passes.

H.B. Bhaskar [2012][10]. Author investigate aluminum metal matrix composites are offering excellent combination of high specific strength, high specific stiffness, electrical and thermal conductivities low coefficients of thermal expansion and wear resistance , AMMC's are being used different verity in automobiles, mining and minerals, aerospace defense and many others relevent sectors. Investigated on unlubricated pin on disc wear test were conducted the wear behavior of the aluminium 2024 alloy and its composites. Result was wear rates of composite lower than that of the matrix alloy.

CONCLUSION

The optical microscopy considered ultra fine grain structure on sample. The tensile strength increase. The result was observed that friction and wear resistance depended on the sliding velocity on Pin on Disc. The main evidence was seen by constricting the wear, friction and dynamic response at 0.25 m/s at this velocity. The energy level directly proportional with acceleration. The result is improve hardness, material strength and wear resistance.

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REFERENCES

[1]Yoshinori Iwahashi, Zenji Horita, Minori Nemoti, and Terence G. Langdon " The process of grain refinement in equal-channel angular pressing" Acta mater. [46][9] pp. 3317-3331, 1998

[2]Y. Saito, H. Utsunomiya, N. Tsuji and T. Sakai "novel ultrahigh straining process for bulk materials development of the accumulative roll bonding process" Acta mater. [47][2], pp. 579-583, 1999

[3]Yuntian Theodore Zhu *, Terry C. Lowe "Observations and issues on mechanisms of grain refinement during ECAP process" Materials Science and Engineering A291 (2000) 46-53

[4]Vladimir V. Stolyarov a, Y. Theodore Zhu b,*, Igor V. Alexandrov a, Terry C. Lowe b Ruslan Z. Valiev a "Influence of ECAP routes on the microstructure and properties of pure Ti Materials Science and Engineering A299 (2001) 59-67

[5]R.S. Mishra a,*, V.V. Stolyarov b, C. Echer c, R.Z. Valiev b, A.K. Mukherjee d "Mechanical behavior and superplasticity of a severe plastic deformation processed nanocrystalline Ti–6Al–4V alloy Materials Science and Engineering A298 (2001) 44-50

[6]A.P. Zhilyaev a,b,*, B.-K. Kim d, G.V. Nurislamova a, M.D. Baro b, J.A. Szpunar c, T.G. Langdon d "Orientation imaging microscopy of ultrafine-grained nickel" Scripta materialia 46 (2002) 575-580

[7]Minoru Furukawa a, Zenji Horita b, Minoru Nemoto c, Terence G. Langdon d,* "The use of severe plastic deformation for micro structural control" Materials Science and Engineering A324 (2002) 82-89

[8]Georgy J. Raab a, Ruslan Z. Valiev a, Terry C. Lowe b, Yuntian T. Zhu b,∗ "Continuous processing of ultrafine grained Al by ECAP–Conform" Materials Science and Engineering A 382 (2004) 30-34

[9]M.T. Pe´rez-Prado *,J.A. del Valle,O.A. Ruano "Grain refinement of Mg– Al– Zn alloys via accumulative roll bonding" Scripta Materialia 51 (2004) 1093-1097

[10]H.B. Bhaskar, Abdul Sharief "Dry sliding wear behaviour of Al 2024 Alloy-Beryl particulate metal matrix composites" ICCOMIM 2012