Design and Analysis of High-Pressure Torsion Process Using Finite Element Method

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Abstract: *High Pressure Torsion (HPT) is a procedure that is frequently used to change the structure and characteristics of materials by using severe plastic deformation. It is widely believed that astraightforward shear causes deformation during HPT. In order to create nanocrystalline structures in metals and alloys as well as to cold weld powders, HPT is utilized. The flow kinematics and stress condition of a material under deformation dictate the HPT treatment's outcome. Recent studies have revealed that the actual plastic flow during HPT might deviate greatly from the straightforward concept.*

Based on a modification of the traditional high pressure torsion technique of severe plastic deformation, a new approach called High Pressure Torsion Extrusion (HPTE) will be proposed. A specimen will be extruded via sectional containers that will be spinning in relation to one another during HPTE. The area where the containers converge on the specimen will be exposed to shear deformation. The findings of the FEM inquiry will be presented in this report

Keywords: HPT (High-pressure torsion) , Strain , Heat Generation , Coefficients of friction, Finite Element Method (FEM) ANSYS

REFERENCES

[1]. S. Khoddama,P. D. Hodgsona, M. H. Parsa , High pressure torsion process of a cylindrical segment sample, Procedia Materials Science (2015) 000–000

[2]. Roman Kulagina, Yan Beygelzimer, Yulia Ivanisenko ,Andrej Mazilkin, Modelling of High Pressure Torsion using FEM, Procedia Engineering 207 (2017) 1445–1450.

[3]. Ankit Kumar Pandey,Nilkumar Prajapati,Kanhu C. Nayak,Prashant P. Dated, Sustainable manufacturing process for recycling of aluminum alloy waste into direct product by high-pressure torsion process Materials Today: Proceedings 18 (2019) 3099–3108.

[4]. Marina Borodachenkova, Wei Wen, A. B. Pereira, High-Pressure Torsion: Experiments and Modelinghttps://dx.doi.org/10.5772/intechopen.69173

[5]. R.B. Figueiredo, M.T.P. Aguilar, P.R. Cetlin, T.G. Langdon, Analysis of plastic flow during high-pressure torsion, J. Mater. Sci. 47 (2012) 7807–7814.

[6]. Evolution of homogeneity in processing by high-pressure torsion. Acta Materialia, 55(1), 203-212. https://doi.org/10.1016/j.actamat.2006.07.029

[7]. R.B. Figueiredo, M.T.P. Aguilar, P.R. Cetlin, T.G. Langdon, Analysis of plastic flow during high-pressure torsion, J. Mater. Sci. 47 (2012) 7807–7814.

[8]. Roberto B., Figueiredo, Terence G, Langdon Processing Magnesium and Its Alloys by High-Pressure Torsion 19 December 2018https://doi.org/10.1002/adem.20180103

[9]. Kawasaki M, Alhajeri SN, Xu C, Langdon TG. The development of hardness homogeneity in pure aluminum and aluminum alloy disks processed by high-pressure torsion. Materials Science and Engineering: A. 2011;529:345–351

[10]. Horita, Z., Langdon, T.G., 2005. Microstructure and microhardness of an aluminums alloy and pure copper after processing by high-pressure torsion. Mater. Sci. Eng. 410–411, 422–425.

[11]. Donya Ahmadkhaniha, Yi Huang ,Matias Jaskari Effect of high-pressure torsion on microstructure, mechanical properties and corrosion resistance of cast pure Mg 53, pages16585–16597 (2018)

[12]. Horita, Z., Langdon, T.G., 2005. Microstructure and microhardness of an aluminums alloy and pure copper after processing by high-pressure torsion. Mater. Sci. Eng. 410–411, 422–425.

Nomenclature

- ε_e = Elastic Strain
- ε_p = Plastic strain
- T_f = Twisting Effort
- D_s = Diameter of Sample
- D_p = Diameter of Punch
- F = Compressive Force
- D_f = Displacement Force
- L = Load
- μ =Coefficients of friction

Biographical Notes

- Ritesh. R. Bharvad Born In the Chhotaudepur in India. He Graduated From Government Engineering College, Dahod In 2021 and Student Of ME CAD/CAM Of Government Engineering College, Dahod. His Areas of Interest Are Design Manufacturing and Metallurgy.

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