UNIVERSITAS
GADJAH MADA
**Optimasi Parameter Proses 3D Printing Material TPU terhadap Aspek Hardness, Stiffness, dan Printing
Time untuk Aplikasi Cushioning Insole**
Rakha Fa'iq Muyassar, Prof. Dr. Eng. Ir. Herianto, S.T., M.Eng., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Anderson, J., Williams, A. E., & Nester, C. (2020). Development and evaluation of a dual density insole for people standing for long periods of time at work. *Journal of Foot and Ankle Research*, *13*(1). https://doi.org/10.1186/s13047-020-00402-2

Casado-Hernández, I., Becerro-de-Bengoa-Vallejo, R., Losa-Iglesias, M. E., Soriano-Medrano, A., López-López, D., Navarro-Flores, E., Pérez-Boal, E., & Martínez-Jiménez, E. M. (2023). The Effectiveness of Hard Insoles for Plantar Pressure in Cycling: A Crossover Study. *Bioengineering*, *10*(7). https://doi.org/10.3390/bioengineering10070816

Chaudhry, M. S., & Czekanski, A. (2020). Evaluating FDM process parameter sensitive mechanical performance of elastomers at various strain rates of loading. *Materials*, *13*(14). https://doi.org/10.3390/ma13143202

Cieza, A., Causey, K., Kamenov, K., Hanson, S. W., Chatterji, S., & Vos, T. (2020). Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, *396*(10267), 2006–2017. https://doi.org/10.1016/S0140-6736(20)32340-0

Cristiana, M., Popescu, D., & Alexandru, T. G. (2024). PRINTABILITY OF THERMOPLASTIC POLYURETHANE WITH LOW SHORE A HARDNESS IN THE CONTEXT OF CUSTOMIZED INSOLES PRODUCTION. *U.P.B. Sci. Bull., Series D*, *86*(2).

Danko, M., Sekac, J., Dzivakova, E., Zivcak, J., & Hudak, R. (2023). 3D Printing of Individual Running Insoles – A Case Study. *Orthopedic Research and Reviews*, *15*, 105–118. https://doi.org/10.2147/ORR.S399624

Demir, S. (2025). Optimization of Mechanical Properties in FDM 3D-Printed PLA Parts: Evaluating the Interaction of Key Parameters. *Journal of Materials Engineering and Performance*, *34*(23), 28566–28580. https://doi.org/10.1007/s11665-025-11320-4

Denis, Y., Braun, L., Hipper, M., Anedda, B., von Diecken, C., Helwig, J., & Willwacher, S. (2025). Determinants of footwear perception in running

UNIVERSITAS GADJAH MADA
Optimasi Parameter Proses 3D Printing Material TPU terhadap Aspek Hardness, Stiffness, dan Printing Time untuk Aplikasi Cushioning Insole
Rakha Fa'iq Muyassar, Prof. Dr. Eng. Ir. Herianto, S.T., M.Eng., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

shoes with different compression stiffnesses. *Footwear Science*, *17*(3), 167–178. https://doi.org/10.1080/19424280.2025.2535283

Dixit, N., & Jain, P. K. (2023). Multi-objective Strength Optimization of Fused Filament Fabricated Complex Flexible Parts Using Grey Relational Analysis. *Iranian Journal of Science and Technology - Transactions of Mechanical Engineering*, *47*(4), 1787–1797. https://doi.org/10.1007/s40997-022-00589-8

Frick, A., Ernst, C., & Taha, I. (2023). Influence of a commonly accepted hardness tolerance on the thermo-mechanical and vibration-insulating properties of an acrylonitrile-butadiene elastomer. *Materialwissenschaft Und Werkstofftechnik*, *54*(10), 1184–1195. https://doi.org/10.1002/mawe.202300033

Gates, L. S., Arden, N. K., Hannan, M. T., Roddy, E., Gill, T. K., Hill, C. L., Dufour, A. B., Rathod-Mistry, T., Thomas, M. J., Menz, H. B., Bowen, C. J., & Golightly, Y. M. (2019). Prevalence of Foot Pain Across an International Consortium of Population-Based Cohorts. *Arthritis Care and Research*, *71*(5), 661–670. https://doi.org/10.1002/acr.23829

Heino, D. J., Telfer, S., Nickerson, K. A., Carranza, C., Varre, M. S., Nagle-Christensen, A., Ledoux, W. R., & Muir, B. C. (2025). Pathways of load transfer in custom accommodative insoles for people with diabetes. *Clinical Biomechanics*, *129*. https://doi.org/10.1016/j.clinbiomech.2025.106645

Hisam, M. W., Dar, A. A., Elrasheed, M. O., Khan, M. S., Gera, R., & Azad, I. (2024). The Versatility of the Taguchi Method: Optimizing Experiments Across Diverse Disciplines. In *Journal of Statistical Theory and Applications* (Vol. 23, Number 4, pp. 365–389). Springer Science and Business Media B.V. https://doi.org/10.1007/s44199-024-00093-9

Ho, M., Nguyen, J., Talbot, K., Heales, L., Kean, C., Kong, P. W., & Stanton, R. (2022). Immediate comfort perception of 3D-printed foot orthoses in individuals with unilateral heel pain. *Prosthetics and Orthotics International*, *46*(1), 31–36. https://doi.org/10.1097/PXR.0000000000000068

UNIVERSITAS GADJAH MADA
Optimasi Parameter Proses 3D Printing Material TPU terhadap Aspek Hardness, Stiffness, dan Printing Time untuk Aplikasi Cushioning Insole
Rakha Fa'iq Muyassar, Prof. Dr. Eng. Ir. Herianto, S.T., M.Eng., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Jung, I., & Lee, S. (2022). Compressive Properties of 3D Printed TPU Samples with Various Infill Conditions. *Journal of the Korean Society of Clothing and Textiles*, *46*(3), 481–493. https://doi.org/10.5850/JKSCT.2022.46.3.481

Kubach, J., Pasurka, M., Lueg, J., & Betsch, M. (2025). Clinical Evaluation of Novel Custom 3D-Printed Meshed-Silicone Orthotics Utilizing Standing Foot Scans and Dynamic Gait Data. *Biomedical Engineering and Computational Biology*, *16*. https://doi.org/10.1177/11795972251371476

Kumar, A., Verma, S., & Jeng, J. Y. (2020). Supportless lattice structures for energy absorption fabricated by fused deposition modeling. *3D Printing and Additive Manufacturing*, *7*(2), 85–96. https://doi.org/10.1089/3dp.2019.0089

Lane, T. J., Landorf, K. B., Bonanno, D. R., Raspovic, A., & Menz, H. B. (2014). Effects of shoe sole hardness on plantar pressure and comfort in older people with forefoot pain. *Gait and Posture*, *39*(1), 247–251. https://doi.org/10.1016/j.gaitpost.2013.07.116

Li, D., Zhang, G., Wu, M., Lin, L., Liu, H., Shi, J., Lu, J., Wang, D., Yang, Y., & Du, K. (2025). Buffering performance of 3D-printed TPU-based packaging: Experimental and numerical analysis. *Mechanics Research Communications*, *148*. https://doi.org/10.1016/j.mechrescom.2025.104492

Ngeow, Y. W., Ismail, N. I. N., Hassim, D. H. A. I., Sarkawi, S. S., Rahim, M. I. S. A., & Yong, K. C. (2024). A comparative evaluation of compression moulded and fused deposition modelling 3D printed thermoplastic polyurethane. *Journal of Rubber Research*, *27*(2), 193–200. https://doi.org/10.1007/s42464-024-00238-6

Orsu, B., & Shaik, Y. P. (2022). Compression Strength Analysis of Customized Shoe Insole with Different Infill Patterns Using 3D Printing. *OALib*, *09*(05), 1–13. https://doi.org/10.4236/oalib.1108712

Pandey, M. K., Kumar, A., & Sujithra, R. (2025). Experimental Investigation of 3D Printing Parameters on Mechanical Properties of TPU-87A and TPU-95A. *Journal of Materials Engineering and Performance*. https://doi.org/10.1007/s11665-025-12653-w

Prajapati, S., Sharma, J. K., Kumar, S., Pandey, S., & Pandey, M. K. (2024). A review on comparison of physical and mechanical properties of PLA, ABS,

UNIVERSITAS GADJAH MADA
Optimasi Parameter Proses 3D Printing Material TPU terhadap Aspek Hardness, Stiffness, dan Printing Time untuk Aplikasi Cushioning Insole
Rakha Fa'iq Muyassar, Prof. Dr. Eng. Ir. Herianto, S.T., M.Eng., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

TPU, and PETG manufactured engineering components by using fused deposition modelling. *Materials Today: Proceedings*. https://doi.org/10.1016/j.matpr.2024.05.018

Schmidt, S. C., Grondz, J. J., Ford, M. J., Armas, J. A., Alexopoulos, A. D., Mendoza, J. T., Loeb, C. K., & Lenhardt, J. M. (2025). 3D printable silicone compositions exhibiting high toughness and low durometer. *Journal of Materials Research*, *40*(10), 1498–1510. https://doi.org/10.1557/s43578-025-01590-y

Shim, D. W., Sung, S. Y., Chung, W. Y., Kang, K. Y., Park, S. J., Lee, J. W., & Chae, D. S. (2021). Superior pedal function recovery of newly designed three spike insole over total contact insole in refractory plantar fasciitis: A randomized, double-blinded, non-inferiority study. *PLoS ONE*, *16*(7 July). https://doi.org/10.1371/journal.pone.0255064

Srinivasan, L., Radhakrishnan, L., Veeranan, E., Mohammad, F. K., Moinuddin, S. Q., & Altammar, H. (2026). NSGA-II-Based Multi-Objective Optimization of Fused Filament Fabrication Process Parameters for TPU Parts with Chemical Smoothing. *Polymers*, *18*(3). https://doi.org/10.3390/polym18030391

Tunçel, O., Tüfekci, K., & Kahya, Ç. (2024). Multi-objective optimization of 3D printing process parameters using gray-based Taguchi for composite PLA parts. *Polymer Composites*, *45*(14), 12870–12884. https://doi.org/10.1002/pc.28674

Wang, C., Li, J., Wang, T., Chu, Q., & Wen, S. (2025). Design and Rapid Prototyping of Packaging Liner for Rosewood Craft based on Gyroid Infill Structure. *BioResources*, 842–851. https://doi.org/10.15376/biores.20.1.842-851

Zhang, J., Lu, S., Yang, Y., Liu, Y., Guo, Y., & Wang, H. (2024). Efficacy of auxetic lattice structured shoe sole in advancing footwear comfort—From the perspective of plantar pressure and contact area. *Frontiers in Public Health*, *12*. https://doi.org/10.3389/fpubh.2024.1412518