

## DAFTAR PUSTAKA

- Antoniw, S., McCarthy, N., Pacey, E., Parkin, B. and Shelton, P., 2013. Additive manufacturing: opportunities and constraints. *Royal Academy of Engineering, 1st edition, London.*
- Baino, F., Novajra, G. and Vitale-Brovarone, C., 2015. Bioceramics and scaffolds: a winning combination for tissue engineering. *Frontiers in bioengineering and biotechnology, 3*, p.202.
- Balu, P., Leggett, P. and Kovacevic, R., 2012. Parametric study on a coaxial multi-material powder flow in laser-based powder deposition process. *Journal of Materials Processing Technology, 212(7)*, pp.1598-1610.
- Bauer, J. and Malone, P., 2015. Cost estimating challenges in additive manufacturing. In *International Cost Estimating and Analysis Association Professional Development and Training Workshop (Vol. 4).*
- Bellucci, D., Sola, A. and Cannillo, V., 2011. Revised replication method for bioceramic scaffolds. *Bioceramics Development and Applications, 1(8)*, p.2011.
- Berger, R., 2013. Additive manufacturing: a game changer for the manufacturing industry. *Roland Berger Strategy Consultants GmbH, Munich, 1(5.1).*
- Beverloo, W.A., Leniger, H.A. and Van de Velde, J., 1961. The flow of granular solids through orifices. *Chemical engineering science, 15(3-4)*, pp.260-269.
- Bose, S., Vahabzadeh, S. and Bandyopadhyay, A., 2013. Bone tissue engineering using 3D printing. *Materials today, 16(12)*, pp.496-504.
- Busachi, A., Erkoyuncu, J., Colegove, P., Martina, F., Watts, C. and Drake, R., 2017. A review of additive manufacturing technology and cost estimation techniques for the defence sector. *CIRP Journal of Manufacturing Science and Technology, 19*, pp.117-128.
- Carr, R.L., Carr, R.L., Carr, R.I. and Carr, R., 1965. Evaluating flow properties of solids. *Chemical Engineering Journal, 72*, 163-168.
- Chen, X., Seyfang, K. and Steckel, H., 2012. Development of a micro dosing system for fine powder using a vibrating capillary. Part 1: The investigation of factors influencing on the dosing performance. *International journal of pharmaceuticals, 433(1-2)*, pp.34-41.
- Chen, X., Seyfang, K. and Steckel, H., 2012. Development of a micro-dosing system for fine powder using a vibrating capillary. Part 2. The implementation of a process analytical technology tool in a closed-loop dosing system. *International journal of pharmaceuticals, 433(1-2)*, pp.42-50.

- Chen, X., Spark, T., Ruan, J. and Liou, F., 2013. The Analysis for The Influence of Vibration Parameters on Laser Metal Deposition Process. *International Journal of Digital Content Technology and its Applications*, 7(1), p.545.
- Chianrabutra, S., Mellor, B.G. and Yang, S., 2014. A dry powder material delivery device for multiple material additive manufacturing. *University of Southampton, Southampton, UK*.
- Gmeiner, R., Deisinger, U., Schönherr, J., Lechner, B., Detsch, R., Boccaccini, A.R. and Stampfl, J., 2015. Additive manufacturing of bioactive glasses and silicate bioceramics. *J. Ceram. Sci. Technol*, 6(2), pp.75-86.
- Cooke, A. and Slotwinski, J., 2012. *Properties of metal powders for additive manufacturing: a review of the state of the art of metal powder property testing* (p. 7873). US Department of Commerce, National Institute of Standards and Technology.
- Cox, S.C., Thornby, J.A., Gibbons, G.J., Williams, M.A. and Mallick, K.K., 2015. 3D printing of porous hydroxyapatite scaffolds intended for use in bone tissue engineering applications. *Materials Science and Engineering: C*, 47, pp.237-247.
- Thompson, S.M., Bian, L., Shamsaei, N. and Yadollahi, A., 2015. An overview of Direct Laser Deposition for additive manufacturing; Part I: Transport phenomena, modeling and diagnostics. *Additive Manufacturing*, 8, pp.36-62.
- Dhodapkar, S., Jacob, K. and Kodam, M., 2016. Determining discharge rates of particulate solids. *Chemical Engineering Progress*, 112(5), pp.50-61.
- Dikova, T.D., 2012. Factors Influencing on the Dimensions Accuracy in Laser Cutting. In *Advanced Materials Research* (Vol. 445, pp. 430-435). Trans Tech Publications Ltd.
- Economist, T., 2012. The third industrial revolution. *The Economist*, 403(8781), p.15.
- Falangas, E.T., Dworak, J.A. and Koshigoe, S., 1994. Controlling plate vibrations using piezoelectric actuators. *IEEE Control Systems Magazine*, 14(4), pp.34-41.
- Foroozmehr, E., Lin, D. and Kovacevic, R., 2009. Application of vibration in the laser powder deposition process. *Journal of Manufacturing Processes*, 11(1), pp.38-44.
- Freeman, R., 2000. The flowability of powders—an empirical approach. *I Mech E*, 566, pp.545-56.
- Freeman, T., 2014. *An Introduction to Powders*. [online] Available at: <https://www.freemantech.co.uk/news/freeman-technology-unveils-a-new-guide-to-powder-behaviour> [Accessed 10 December 2019].
- Gavatte, S.J., 2005. Optimization of process parameters for direct metal deposition of nickel. Electronic Theses and Dissertations. Paper 525. <https://doi.org/10.18297/etd/525>
- Guvendiren, M., Molde, J., Soares, R.M. and Kohn, J., 2016. Designing biomaterials for 3D printing. *ACS biomaterials science & engineering*, 2(10), pp.1679-1693.



- Hopkinson, N. and Dicknes, P., 2003. Analysis of rapid manufacturing—using layer manufacturing processes for production. *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science*, 217(1), pp.31-39.
- Hu, G., Hu, Z., Jian, B., Liu, L. and Wan, H., 2010, August. On the determination of the damping coefficient of non-linear spring-dashpot system to model Hertz contact for simulation by discrete element method. In *2010 WASE International Conference on Information Engineering* (Vol. 3, pp. 295-298). IEEE.
- Hunt, M.L., Weathers, R.C., Lee, A.T., Brennen, C.E. and Wassgen, C.R., 1999. Effects of horizontal vibration on hopper flows of granular materials. *Physics of fluids*, 11(1), pp.68-75.
- Jakus, A.E., Rutz, A.L. and Shah, R.N., 2016. Advancing the field of 3D biomaterial printing. *Biomedical Materials*, 11(1), p.014102.
- Jamison, J., 2010. Handling, drying, and reclaim considerations for PLA, Newsletter Plastic Today, April 06.
- Jasion, G.T., Shrimpton, J.S., Li, Z. and Yang, S., 2013. On the bridging mechanism in vibration controlled dispensing of pharmaceutical powders from a micro hopper. *Powder technology*, 249, pp.24-37.
- Jiang, Y., Matsusaka, S., Masuda, H. and Qian, Y., 2009. Development of measurement system for powder flowability based on vibrating capillary method. *Powder Technology*, 188(3), pp.242-247.
- Kong, C.Y., Carroll, P.A., Brown, P. and Scudamore, R.J., 2007, May. The effect of average powder particle size on deposition efficiency, deposit height and surface roughness in the direct metal laser deposition process. In *14th International Conference on Joining of Materials*.
- Kumar, P., Beck, E. and Das, S., 2003. Preliminary Investigations on the Deposition of Fine Powders Through Miniature Hopper-Nozzles Applied to Multi-Material Solid Freeform Fabrication 82. In *2003 International Solid Freeform Fabrication Symposium*.
- Kumar R. Solid State Laser and Its Application. [http://www.nitttrchd.ac.in/sitenew1/app\\_sc/ppts/laser/Solid%20State%20Lasers%20and%20Applns\\_RK.pdf](http://www.nitttrchd.ac.in/sitenew1/app_sc/ppts/laser/Solid%20State%20Lasers%20and%20Applns_RK.pdf).
- Langston, P.A., Matchett, A.J., Fraige, F.Y. and Dodds, J., 2009. Vibration induced flow in hoppers: continuum and DEM model approaches. *Granular Matter*, 11(2), pp.99-113.
- Lee, H.R., Kim, H.J., Ko, J.S., Choi, Y.S., Ahn, M.W., Kim, S. and Do, S.H., 2013. Comparative characteristics of porous bioceramics for an osteogenic response in vitro and in vivo. *PLoS One*, 8(12).

- Lewis, G.K. and Schlienger, E., 2000. Practical considerations and capabilities for laser assisted direct metal deposition. *Materials & Design*, 21(4), pp.417-423.
- Luding, S., 2005. Shear flow modeling of cohesive and frictional fine powder. *Powder technology*, 158(1-3), pp.45-50.
- Lusquiños, F., Pou, J., Arias, J.L., Boutinguiza, M., León, B., Pérez-Amor, M., Driessens, F.C.M., Merry, J.C., Gibson, I., Best, S. and Bonfield, W., 2001. Production of calcium phosphate coatings on Ti6Al4V obtained by Nd: yttrium–aluminum–garnet laser cladding. *Journal of Applied Physics*, 90(8), pp.4231-4236.
- Masuda, H., Higashitani, K. and Yoshida, H. eds., 2006. *Powder technology: fundamentals of particles, powder beds, and particle generation*. CRC press.
- Nazir, K., Sohn, C.H., Hassan, F., Awais, M., Ali, M. and Miran, S., 2014. Optimizing the Efficiency in Direct Laser Deposition Process Using Vibrations of Nozzle to Control the Flow of Powder. In *ASME 2014 International Mechanical Engineering Congress and Exposition*. American Society of Mechanical Engineers Digital Collection.
- Nazir, K., Ahmad, F., Miran, S. and Sohn, C.H., 2017. A parametric analysis of direct laser deposition process using vibration control feeding system. *The International Journal of Advanced Manufacturing Technology*, 89(5-8), pp.1669-1676.
- Pan, H., Sparks, T., Thakar, Y.D. and Liou, F., 2006. The investigation of gravity-driven metal powder flow in coaxial nozzle for laser-aided direct metal deposition process.
- Pinkerton, A.J., Syed, W.U.H. and Li, L., 2007. Theoretical analysis of the coincident wire-powder laser deposition process.
- Prescott, J.K. and Barnum, R.A., 2000. On powder flowability. *Pharmaceutical technology*, 24(10), pp.60-85.
- Qi, L., Zeng, X., Zhou, J., Luo, J. and Chao, Y., 2011. Stable micro-feeding of fine powders using a capillary with ultrasonic vibration. *Powder technology*, 214(2), pp.237-242.
- Rackl, M., Götsch, F.E. and Günthner, W.A., 2017. Angle of repose revisited: When is a heap a cone?. In *EPJ Web of Conferences* (Vol. 140, p. 02002). EDP Sciences.
- Rho, J.Y., Kuhn-Spearing, L. and Zioupos, P., 1998. Mechanical properties and the hierarchical structure of bone. *Medical engineering & physics*, 20(2), pp.92-102.
- Russias, J., Saiz, E., Nalla, R.K., Gyn, K., Ritchie, R.O. and Tomsia, A.P., 2006. Fabrication and mechanical properties of PLA/HA composites: a study of in vitro degradation. *Materials Science and Engineering: C*, 26(8), pp.1289-1295.
- Schulze, D., 2006. *Flow Properties of Powders and Bulk Solids*, Braunschweig/Wolfenbu Ttel.
- Spink, C.D. and Nedderman, R.M., 1978. Gravity discharge rate of fine particles from hoppers. *Powder Technology*, 21(2), pp.245-261.



- Stichel, T., Laumer, T., Baumüller, T., Amend, P. and Roth, S., 2014. Powder layer preparation using vibration-controlled capillary steel nozzles for Additive Manufacturing. *Physics Procedia*, 56, pp.157-166.
- Thavornnyutikarn, B., Chantarapanich, N., Sitthiseripratip, K., Thouas, G.A. and Chen, Q., 2014. Bone tissue engineering scaffolding: computer-aided scaffolding techniques. *Progress in biomaterials*, 3(2-4), pp.61-102.
- Thompson, S.M., Bian, L., Shamsaei, N. and Yadollahi, A., 2015. An overview of Direct Laser Deposition for additive manufacturing; Part I: Transport phenomena, modeling and diagnostics. *Additive Manufacturing*, 8, pp.36-62.
- Tomas, J., 2004. Fundamentals of cohesive powder consolidation and flow. *Ganular Matter*, 6(2-3), pp.75-86.
- Velasco, M.A., Narváez-Tovar, C.A. and Garzón-Alvarado, D.A., 2015. Design, materials, and mechanobiology of biodegradable scaffolds for bone tissue engineering. *BioMed research international*, 2015.
- Wang, L., Pratt, P., Felicelli, S.D., El Kadiri, H., Berry, J.T., Wang, P.T. and Horstemeyer, M.F., 2009. Experimental analysis of porosity formation in laser-assisted powder deposition process. *Miner. Met. Mater. Soc, I*, pp.389-396.
- Wang, W., 2011. High-quality high-material-usage multiple-layer laser deposition of nickel alloys using sonic or ultrasonic vibration powder feeding. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, 225(1), pp.130-139.
- Wassgen, C.R., Hunt, M.L., Freese, P.J., Palamara, J. and Brennen, C.E., 2002. Effects of vertical vibration on hopper flows of ganular material. *Physics of Fluids*, 14(10), pp.3439-3448.
- Wei, G. and Ma, P.X., 2004. Structure and properties of nano-hydroxyapatite/polymer composite scaffolds for bone tissue engineering. *Biomaterials*, 25(19), pp.4749-4757.
- Widyanto, S., Tontowi, A., Jamasri, J. and Rochardjo, H.S.B., 2010. Development of Low Frequency Vibration Method of Direct-Write Deposition Relevant to Layer Manufacturing Application. *Makara Journal of Technology*, 9(2), pp.53-55.
- Wu, H., Pritchett, D., Wolff, S., Cao, J., Ehmann, K., Zou, P., 2020, A Vibration Assisted Delivery System for Additive Manufacturing, *Journal of Additive Manufacturing* 34, 101170
- Yu, W., Muteki, K., Zhang, L. and Kim, G., 2011. Prediction of bulk powder flow performance using comprehensive particle size and particle shape distributions. *Journal of pharmaceutical sciences*, 100(1), pp.284-293.
- Zekovic, S., Dwivedi, R. and Kovacevic, R., 2006. An investigation of gas-powder flow in laser-based direct metal deposition. *Research Center for Advanced Manufacturing, Southern Methodist University*, 1500.



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**PENGEMBANGAN METODE DEPOSISI GETARAN MATERIAL SERBUK UNTUK APLIKASI ADDITIVE  
MANUFACTURING**

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Zekovic, S., Dwivedi, R., & Kovacevic, R. 2007. Numerical simulation and experimental investigation of gas–powder flow from radially symmetrical nozzles in laser-based direct metal deposition. *International Journal of Machine Tools and Manufacture*, 47(1), pp. 112-123.