

## New Application of Powder Injection Molded Product in Medical Field

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Nowadays, majority part of powder injection molding (PIM) market in Europe consists in automotive (43 %). In contrast, to medical applications only 13 % of market is devoted. This paper is focused on a new design and production technology of the adenoid cutting curette used in otorhinolaryngology. In the theoretical part, the present design issues of the cutting curette are shown, and time consumption and wear problems of sterilisation are described. Experimental part consists in selection of suitable metal powder for medical application, computer-aided engineering (CAE) Moldflow analysis of proper gating system followed by construction of injection mold and production of real samples. The new design of replaceable cutting edge is easily customized according to various shapes of patient oral cavity and for doctor's need.

**Keywords:** PIM, Adenoid, Otorhinolaryngology, Medical Device, Curette.

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### References

- [1] GERMAN, R. M., BOSE, A. (1997). *Injection Molding of Metals and Ceramics*. Priceton, New Jersey.
- [2] HEANEY, D. F. (2012). *Handbook of metal injection molding*. Woodhead Publishing Limited, Cambridge.
- [3] GERMAN, R. M. (2011) *Metal injection molding, A comprehensive MIM design guide*. Princeton, NY.
- [4] RAK, Z. S. (1999). New trends in powder injection moulding. *Powder metallurgy and metal ceramics*, vol. 38(4), pp.126-132.
- [5] HAUSNEROVA, B. (2011). Powder Injection Molding – An Alternative Processing Method for Automotive Items, *New Trends and Developments in Automotive Systems Engineering*, pp. 130-146.
- [6] HAUSNEROVA, B., SANETRNIK, D., PONIZIL, P. (2013). Surface structure analysis of injection molded highly filled polymer melts, *Polymer Composites*, Vol. 34, pp. 1553–1558.
- [7] GASBARRE, T.G., JANDESCA, W.F. (1989). *Advances in Powder Metallurgy*, Metal Powder Industries Federation, Princeton, NJ.
- [8] HAUSNEROVA, B., MARCANIKOVA, L., FILIP, P., SAHA P. (2011). Optimization of powder injection molding of feedstock based on aluminium oxide and multicomponent water-soluble polymer binder. *Polymer Engineering & Science*, vol. 51(7), pp. 1376-1382.
- [9] RATNER, B. D. (2004). *Biomaterials Science: An Introduction to Materials in Medicine*. Academic Pres, Amsterdam.
- [10] WILLIAMS, N. (2012). PM2012 World Congress: Special Interest Seminar Reveals Strong Global Growth for PIM, with Asia Leading the Way. *Powder injection moulding international*, vol. 6(4), p.47.
- [11] SIDAMBE, A. T., FIGUERO, I. A., HAMILTON, H. G. C., TODD, I. (2012). Metal injection moulding of CP-Ti components for biomedical applications, *Journal of Materials Processing Technology*, vol. 212(7), pp.1591-1597.
- [12] NEWELL, M. A., DAVIES, H. A., MESSER, P. F., GREENSMITH, D. J. (2005). Metal injection moulding of scissors using hardenable stainless steel powders, *Powder metallurgy*, vol. 48(3), pp.227-230.