

Quantitative Evaluation of the Shape of Graphite (Circularity) in Graphitic Cast Irons

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Shape of graphite in graphitic cast irons is the most important microstructural parameter affecting mechanical properties. The paper deals with evaluation of the shape of graphite in cast irons by shape factor (circularity). Three specimens of graphitic cast irons with different shape of graphite (lamellar, vermicular and nodular) were used for experiments. The aim of this study has been to understand the influence of microstructure (especially shape of graphitic particles) on mechanical properties of graphitic cast irons. However, the evaluation of shape factor is a subject of interest in many fields of applications such as medicine and industrial processes, not only materials engineering. The shape factor plays an important role in materials science as a way to understand the relationship between microstructure and mechanical properties of technical materials.

Keywords: Cast iron, Graphite, Shape factor, Circularity, Nodularity

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References

- [1] SKOČOVSKÝ, P., PODRÁBSKÝ, T. (2005). *Graphitic cast irons*, EDIS, Žilina. (in Slovak)
- [2] SKOČOVSKÝ, P., BOKŮVKA, O., KONEČNÁ, R., TILLOVÁ, E. (2014). *Materials science*, EDIS, Žilina. (in Slovak)
- [3] LEKAKH, S.N., QING, J., RICHARDS, V.L., PEASLEE, K.D. (2013). Graphite nodule size distribution in ductile iron. In: *AFS Proceedings*, pp. 1-8. Schaumburg, USA.
- [4] ULEWICZ, R. (2014). Practical application of quality tools in the cast iron foundry. In: *Manufacturing Technology*, Vol. 14, No. 1, pp. 104-111.
- [5] VAŠKO, A., SKOČOVSKÝ, P. (2014). *Properties and using of metal materials*, EDIS, Žilina. (in Slovak)
- [6] SKOČOVSKÝ, P., VAŠKO, A. (2007). *Quantitative evaluation of structure of cast irons*, EDIS, Žilina. (in Slovak)
- [7] VAŠKO, A., MARKOVIČOVÁ, L., ZATKALÍKOVÁ, V., TILLOVÁ, E. (2014). Quantitative evaluation of microstructure of graphitic cast irons. In: *Manufacturing Technology*, Vol. 14, No. 3, pp. 478-482.
- [8] RIBEIRO, C.A.S., SÁ, C., MALHEIROS, L.F., BAUMGART, W., WÜLLER, E., DONHAUSER, M., HENKE, C. (2006). Relationship between image analysis graphite shape factors, mechanical properties and thermal analysis solidification behaviour of compact cast irons. In: *Proceedings of 8th international symposium on science and processing of cast iron*, pp. 169-174. Beijing, China.
- [9] GOMES, O.F.M., PACIORNIK, S. (2005). Automatic classification of graphite in cast iron, In: *Microscopy and Microanalysis*, Vol. 11, No. 4, pp. 363-371.
- [10] HERRERA-NAVARRO, A.M., HERNÁNDEZ, H.J., PEREGRINA-BARRETO, H. (2013). A new measure of circularity based on distribution of the radius. In: *Computación y Sistemas*, Vol. 17, No. 4, pp. 515-526.
- [11] LI, J., LU, L., LAI, M.O. (2000). Quantitative analysis of the irregularity of graphite nodules in cast iron. In: *Materials Characterization*, Vol. 45, No. 2, pp. 83-88.
- [12] IMASOGIE, B.I., WENDT, U. (2004). Characterization of graphite particle shape in spheroidal graphite iron using a computer-based image analyzer. In: *Journal of Minerals & Materials Characterization & Engineering*, Vol. 3, No.1, pp. 1-12.
- [13] SANTIS, A., BARTOLOMEO, O., IACOVIELLO, D., IACOVIELLO, F. (2008). Quantitative shape evaluation of graphite particles in ductile iron. In: *Journal of Materials Processing Technology*, Vol. 196, pp. 292-302.
- [14] GRENIER, S., LABRECQUE, C., BHATTACHARJEE, A., GUNDLACH, R., KROKA, B., RIABOV, M. (2014). Inter-laboratory study of nodularity and nodule count of ductile iron by image analysis. In: *International Journal of Metalcasting*, Vol. 8, No. 2, pp. 51-63.