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Liquid phase sintering of self-lubricating Fe-hBN composites

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When conventional powder metallurgy is used to process materials with embedded lamellar solid lubricants, by adding it as powder during mixing process, spreading of solid lubricant occurs during mechanical homogenization due to its low shear strength, forming films. This restrains the formation of contacts during sintering, which results in low mechanical properties of the material [1]. In order to improve the distribution of the solid lubricant in the matrix, liquid phase sintering can be used to process the material [2]. In the present work, self-lubricating composites presenting embedded solid lubricant (hexagonal boron nitride - hBN) in a ferrous matrix, with and without liquid phase during sintering, were produced. The chosen element to form liquid phase was copper. The samples were produced by mixing powders, pressing at 700 MPa and sintering at 1125 °C, with atmosphere of 95%N₂/5%H₂. The liquid phase sintering, by adding copper, improved the degree of continuity of the matrix by rearranging the solid lubricant particles (Figure 1). With this, besides the hardening effect of the copper on the matrix, the mechanical properties of the composites were improved, with tensile strength increasing up to 230% when compared to the same composite without copper (Table 1).

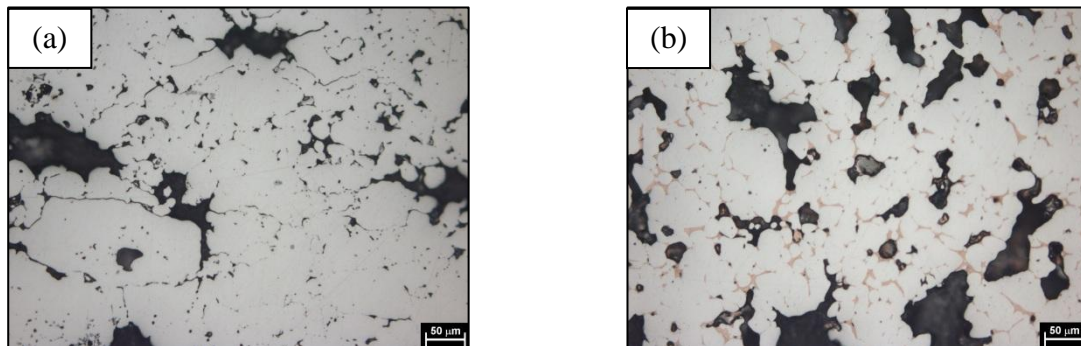


Figure 1: Optical micrographs of sintered iron samples containing 5 vol% hBN, with no liquid phase during sintering (a) and with liquid phase by adding 15 wt% (b).

Table 1 – Tensile strength of sintered samples.

	0 vol% hBN	2,5% vol% hBN	5% vol% hBN
0 wt% Copper	202 MPa	124 MPa	77 MPa
15 wt% Copper	306 MPa	293 MPa	255 MPa

Keywords: Powder metallurgy, Liquid phase sintering, Self-lubricating composite.

[1] A.N. Klein, C. Binder, G. Hammes; J.D.B. de Mello, W. Ristow Jr, R. Binder. Proceedings of EURO PM2009, Vol. 1(2009) 191-196;

[2] R. Binder, A.N. Klein, C. Binder, G. Hammes, M.L. Parucker, W. Ristow Jr. Patent application PI 0803956-9, INPI, Brazil, 2008.

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