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Hendriksen, Peter Vang; Mørup, Steen; Koch, Christian; Linderorth, Søren; Bødker, F.

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Compaction of amorphous iron–boron powder (abstract)

P. V. Hendriksen, S. Mørup, C. B. Koch, and S. Linderoth

Laboratory of Applied Physics, Technical University of Denmark, DK-2800 Lyngby, Denmark

F. Bødker

Department of Chemistry, University College of North Wales, Bangor, Gwynedd LL57 2UW, United Kingdom

Large scale practical use of bulk amorphous alloys requires the capability of molding the material to a desired design, for instance by compaction of an amorphous powder. This is a difficult task because the sintering temperature is limited by the crystallization temperature of the alloy.¹ Here we report on attempts to compact amorphous iron–boron particles prepared by chemical reduction of Fe(II) ions in aqueous solution by NaBH₄ (Ref. 2). The particles prepared in this way are pyrophoric, but can be passivated. The small particle size (10–100 nm), characteristic of this preparation technique, should facilitate a compaction. The passivation layer, however, impedes a compaction. Isostatic pressing at 540 K at a pressure of 200 MPa clearly illustrated this; pellets pressed from passivated powder were much more brittle than pellets pressed from unpassivated powder. The density of the pellets was very low ($\approx 25\%$ of the density of bulk FeB). We have designed a die for uniaxial pressing in which the compaction can be performed without exposing the powder to air and have obtained densities larger than 60% of that of bulk FeB. We have reported studies of the dependence of density and structure on compaction pressure and compaction temperature.

¹Y. Kawamura, M. Tagaki, M. Senoo, and T. Imura, *Mater. Sci. Eng.* **98**, 415 (1988).

²S. Linderoth and S. Mørup, *J. Appl. Phys.* **69**, 5256 (1991).