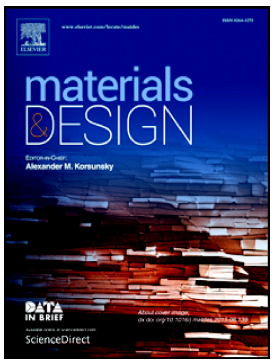

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PII:	S0264-1275(17)31036-5
DOI:	doi:10.1016/j.matdes.2017.11.008
Reference:	JMADE 3484
To appear in:	*Materials & Design*
Received date:	27 June 2017
Revised date:	2 November 2017
Accepted date:	3 November 2017

Please cite this article as: K.K. Song, X.L. Han, S. Pauly, Y.S. Qin, K. Kosiba, C.X. Peng, J.H. Gong, P.X. Chen, L. Wang, B. Sarac, S. Ketov, M. Mühlbacher, F. Spieckermann, I. Kaban, J. Eckert , Rapid and partial crystallization to design ductile CuZr-based bulk metallic glass composites. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jmade(2017), doi:10.1016/j.matdes.2017.11.008

Rapid and partial crystallization to design ductile CuZr-based bulk metallic glass composites

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Abstract

Transformation-induced plasticity in CuZr-based bulk metallic glass (BMG) composites opens up a new perspective for the design of ductile BMG composites. In this work, rapid and partial crystallization of BMGs is proposed to tailor microstructures of ductile BMG composites. During the early crystallization stage, the precipitation of B2 CuZr crystals in the $Cu_{42}Zr_{42}Al_{10}Co_6$ BMGs is growth-controlled at low or high heating rates after having passed through a nucleation-dominated temperature region. Abundant nucleation is beneficial for the uniform precipitation of B2 crystals in the glassy matrix. Compared with annealing processes at slow heating, the degree of the free volume annihilation could be reduced to some content by employing a high heating rate. The microstructures of CuZr-based BMG composites can be effectively tuned by changing rapid annealing parameters, which enhances the ductility of the resulting BMG composites. This approach proves to be efficient for the development of ductile metastable alloys and composites.