frontiers in Materials

EDITORIAL
published: 24 March 2022
doi: 10.3389/fmats.2022.874556

Editorial: Fundamentals and Challenges of Advanced Amorphous and High-Entropy Alloys

Kaikai Song[1], Yongjiang Huang[2], Ran Li[3], Jichao Qiao[4], Zhi Wang[5], Konda Gokuldoss Prashanth[6,7] and Daniel Sopu[6]*

[1]School of Mechanical, Electrical and Information Engineering, Shandong University, Weihai, China, [2]School of Materials Science and Engineering, Harbin Institute of Technology, Harbin, China, [3]Key Laboratory of Aerospace Materials and Performance (Ministry of Education), School of Materials Science and Engineering, Beihang University, Beijing, China, [4]School of Mechanics, Civil Engineering and Architecture, Northwestern Polytechnical University, Xi'an, China, [5]National Engineering Research Center of Near-net-shape Forming for Metallic Materials, School of Mechanical and Automotive Engineering, South China University of Technology, Guangzhou, China, [6]Erich Schmid Institute of Materials Science, Austrian Academy of Sciences, Leoben, Austria, [7]Department of Mechanical and Industrial Engineering, Tallinn University of Technology, Tallinn, Estonia

Keywords: amorphous alloys, high-entropy alloys, liquid structure, mechanical properties, deformation mechanism

Editorial on the Research Topic

Fundamentals and Challenges of Advanced Amorphous and High-Entropy Alloys

In recent years, high-entropy alloys and amorphous alloys have attracted much attention due to their respective structural features and performance advantages. In the development history of amorphous alloys, the concept of "entropy" has been widely studied as one of the important factors affecting the glass-forming ability. To develop bulk amorphous alloys with high glass-forming ability, Greer (1993) and Inoue (2000) proposed the "Confusion principle" and "Three empirical principles," respectively. Therefore, the multi-component mixing mode is usually adopted to promote the formation of the amorphous phase. On the other hand, to break through the single principal component design concept of traditional metal alloys, the multiple-principal component concept was also introduced into the composition design of metal alloys and then the concept of the high-entropy alloys was proposed (Cantor, et al., 2004; Yeh, et al., 2004). Soon afterward, people realized that the design concept of high-entropy alloy also provides a broad composition design space for finding new bulk amorphous alloys.

The goal of the present research topic is to collect articles mainly concerning the frontiers of research in amorphous and high-entropy alloys. In this topic, four papers were finally published, which were about the local structure, 3D balanced growth theory, and mechanical properties of bulk amorphous alloys. Zhang et al. summarized the development of amorphous alloys, high-entropy alloys, and high-entropy amorphous alloys (**Figure 1A**) and addressed that the production and development of bulk amorphous alloys have a bright future. Sun et al. investigated the local structures of glass-forming melts and found that two sub-peaks in the first peaks of the total pair distribution function can be attributed to two kinds of U-centered clusters. According to simulation results, not only topological but also chemical structural heterogeneities also appear in amorphous alloys (**Figure 1B**). Furthermore, Huang et al. and Zhang et al. investigated the mechanical properties of multi-principal amorphous alloys (**Figures 1C,D**). These

OPEN ACCESS

Edited and reviewed by:
John L. Provis,
The University of Sheffield,
United Kingdom

****Correspondence:***
Kaikai Song
songkaikai8297@gmail.com

Received: *12 February 2022*
Accepted: *24 February 2022*
Published: *24 March 2022*

Citation:
Song K, Huang Y, Li R, Qiao J, Wang Z, Prashanth KG and Sopu D (2022) Editorial: Fundamentals and Challenges of Advanced Amorphous and High-Entropy Alloys. Front. Mater. 9:874556. doi: 10.3389/fmats.2022.874556

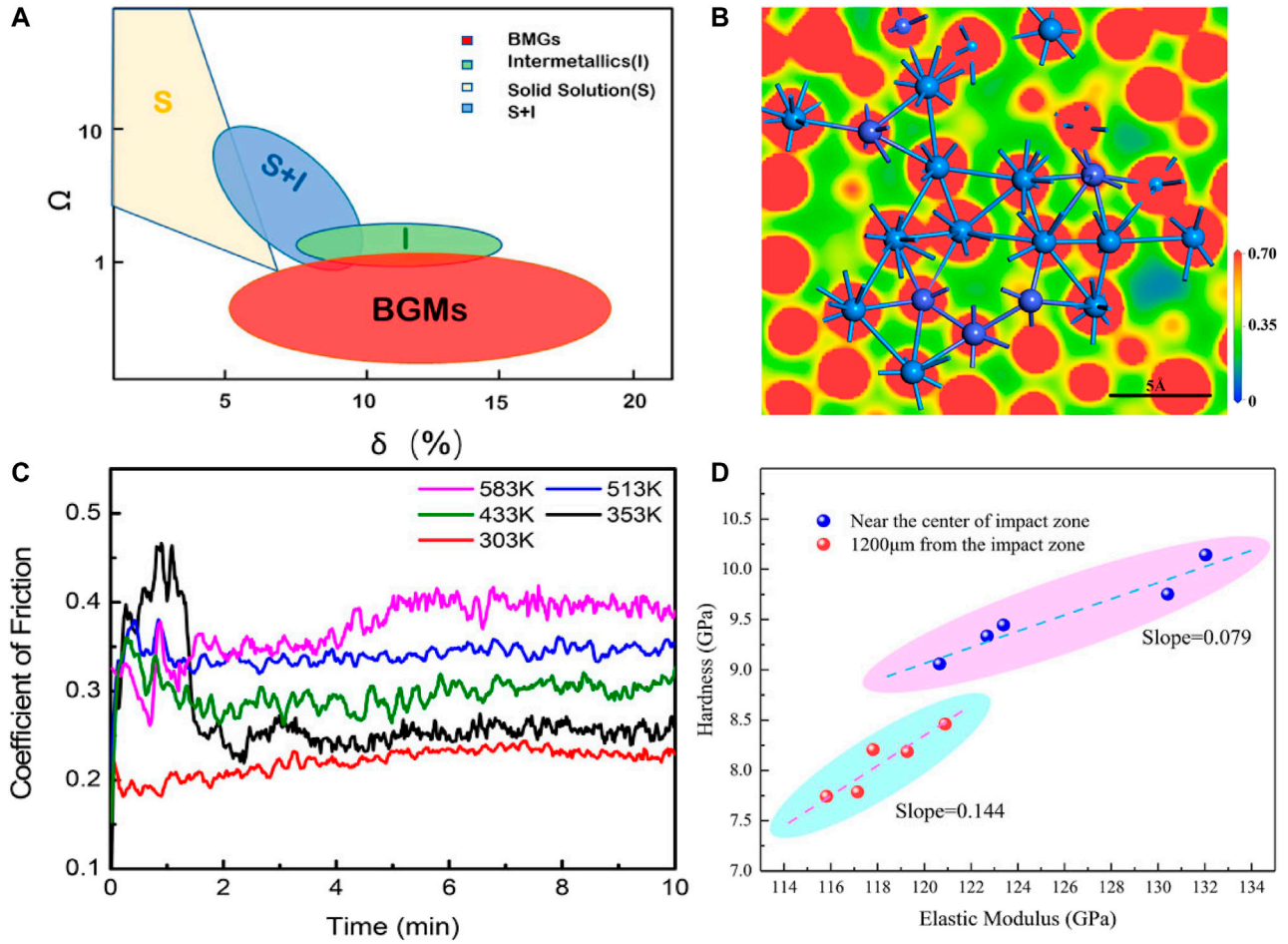

FIGURE 1 | (A) Relationship between the parameters Ω and δ of multicomponent alloys and the amorphous phase region, **(B)** the slice map of electron density of U-Co melts, **(C)** the coefficient of friction of the Ti-based BMG sample tested at different temperatures with an applied load of 3.5 N, and **(D)** the hardness as a function of the elastic modulus of samples after laser shock peanning.

observations may shed more insights into the deformation mechanism of amorphous alloys and promote their future industrial applications.

AUTHOR CONTRIBUTIONS

KS: Investigation, Formal analysis, Writing-original draft, Writing-review and editing; YH: Formal analysis, Writing-review and editing; RL: Formal analysis, Writing-review and editing; JQ: Formal analysis, Writing-review and editing; ZW: Formal analysis, Writing-review and editing; KP: Formal analysis, Writing-review and editing; DS: Formal analysis, Writing-review and editing.

ACKNOWLEDGMENTS

The author is grateful to Dr. Yu Wang for technical assistance.

REFERENCES

Cantor, B., Chang, I. T. H., Knight, P., and Vincent, A. J. B. (2004). Microstructural Development in Equiatomic Multicomponent Alloys. *Mater. Sci. Eng. A* 375-377, 213–218. doi:10.1016/j.msea.2003.10.257

Greer, A. L. (1993). Confusion by Design. *Nature* 366, 303–304. doi:10.1038/366303a0

Inoue, A. (2000). Stabilization of Metallic Supercooled Liquid and Bulk Amorphous Alloys. *Acta Materialia* 48, 279–306. doi:10.1016/S1359-6454(99)00300-6

Yeh, J.-W., Chen, S.-K., Lin, S.-J., Gan, J.-Y., Chin, T.-S., Shun, T.-T., et al. (2004). Nanostructured High-Entropy Alloys with Multiple Principal Elements: Novel

alloy Design Concepts and Outcomes. *Adv. Eng. Mater.* 6, 299–303. doi:10.1002/adem.200300567

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.