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Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):

Qiao, A., Tao, H. Z., Zhang, Y. R., & Yue, Y. (2017). *Indentation behavior and hardness of a melt-quenched metal-organic framework glass*. Abstract from 7th International Workshop on Flow and Fracture of Advanced Glasses, Aalborg, Denmark.

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Indentation behavior and hardness of a melt-quenched metal-organic framework glass

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The melt-quenched metal-organic framework (MQ-MOF) glasses are a new family of glasses [1-3]. For potential applications and optimum design of such glasses, it is important to characterize and investigate their physical and chemical properties. However, these properties have, so far, not been documented in literature. In this work, we focus on studying the indentation behavior and hardness of MQ-MOF glasses by taking ZIF-62 as an example. Its chemical formula is $Zn(\text{Im})_{1.75}(\text{bIm})_{0.25}$, where Im and bIm represent imidazole and benzimidazole, respectively. We measure the Vickers hardness of a series of ZIF-62 glasses with varying bIm content. The results show that the Vickers hardness of the ZIF-62 glasses increases linearly with an increase of bIm. The origin of this linear trend is discussed in terms of structural evolution. We also reveal the deformation mechanism in ZIF-62 glasses during indentation by performing annealing experiments and atomic force microscopy measurements. The change of the ratio between densification and plastic deformation is determined to find out which of the two is the governing factor for the composition dependence of hardness. In summary, this work provides useful information for tailoring the mechanical properties of MQ-MOF glasses.

References:

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