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Impact of Pressure on Glass Transition Behavior of a Metal-Organic Framework Glass

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A newly emerged family of melt-quenched glasses - metal-organic framework (MOF) glasses with network structure, show a number of fascinating physical properties, distinct from those of traditional families of glasses (organic, inorganic and metallic glasses). In this presentation, we report on the influences of pressure on the glass transition temperature (T_g) of ZIF-62 ($Zn(Im)_{1.75}(bIm)_{0.25}$) glass, which was prepared by spark plasma sintering (SPS) method. It is found that the T_g (558K) of ZIF-62 glass produced by SPS method is much lower value than that (595K) prepared by the conventional melt-quenching method. This indicates that the pressure (50 MPa) applied by SPS method to the glass samples densify the glass structure, thereby lower T_g. This behavior is in strong contrast to that of other types of network glasses, since their T_g values remain unchanged under such low pressure. Reheating the as-prepared glass leads to relaxation of the compressed structure to the unconstrained state, and hence, its T_g increase to that of the not pressed ZIF-62 glass. We discuss the structural origin of the decrease of T_g induced by pressure. This work sheds light on the glass transition and relaxation in MOF glasses.