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Abstract: SiO_2, P_2O_5, B_2O_3, and Al_2O_3 are all well-known network formers in glassy solids, but the structure and properties of mixed Al_2O_3-B_2O_3-P_2O_5-SiO_2 glasses without the presence of network modifiers are poorly understood. The relatively low atomic packing density of these glasses should favor network densification when subjected to high local stress (e.g., indentation) at room temperature, and it is therefore interesting to examine their structural response to high pressure treatment. In the present study, we investigate the pressure-induced changes in volume, structure, and mechanical properties (hardness and crack resistance) of two Al_2O_3-B_2O_3-P_2O_5-SiO_2 glass series with varying Si/P and Si/B ratio, respectively. The glasses are isostatically compressed at 1 or 2 GPa at the glass transition temperature, enabling permanent densification of bulk sample specimens. We discuss the pressure-induced changes in glass properties in relation to the structural changes quantified through Raman and ^{11}B, ^{27}Al, and ^{31}P NMR spectroscopy.