RESONANT ULTRASOUND SPECTROSCOPY OF BULK METALLIC GLASSES

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Bulk metallic glasses have recently attracted much interest due to their outstanding elastic properties, opening the way for applications of these amorphous systems as structural materials for various constructions.[1] The work to be carried out using the NHMFL facility was to utilize resonant ultrasound spectroscopy (RUS) to determine the elastic constants of three such materials above room temperature. The materials of interest for this study were $Zr_{52.5}Cu_{17.9}Ni_{14.6}Al_{10}Ti_5$, $Zr_{50}Cu_{40}Al_{10}$, and $Zr_{50}Cu_{30}Ni_{10}Al_{10}$.

RUS is the technique of choice to obtain all elastic constants of these materials in a non-destructive way as a function of temperature. The elastic constants for the materials under study have been measured previously between 4 and 250 K, see Fig. 1, and this proposal aims to extend this study to higher temperatures. Indeed, it has been recently shown that the fragility of a glass forming liquid is intimately related to the ratio between the shear and bulk modulus, more precisely, to Poisson's ratio of the corresponding glass phase.[2] It is hence crucial to get a determination of Poisson's ratio at higher temperature, as close as possible to the critical temperature, above which the systems recrystallizes.

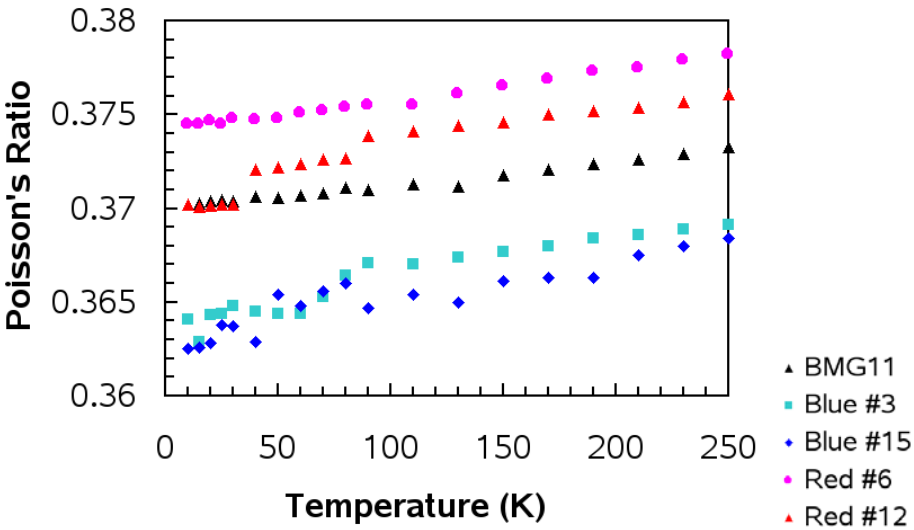

Fig. 1: Poisson's ratio for $Zr_{52.5}Cu_{17.9}Ni_{14.6}Al_{10}Ti_5$ (BMG11), $Zr_{50}Cu_{40}Al_{10}$ (Blue), and $Zr_{50}Cu_{30}Ni_{10}Al_{10}$ (Red).

The calculation of the elastic constants from of the obtained RUS spectra data is not yet complete.

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References

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[2] V. N. Novikov et al., Nature **431**, 961-963 (2004).