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Abstract

Precision measurements of the high-frequency shear modulus G and internal friction Q^{-1} on bulk Pd- and Zr-based glasses upon thermocycling from room temperature up to the glass transition and back have been performed. Together with the pronounced shear softening and related increase of the internal friction upon approaching the glass transition temperature, a strong hysteresis of G and Q^{-1} upon cooling has been found. It has been revealed that the shear softening can be quantitatively described as a result of the generation of interstitialcy defects near the glass transition.

Keywords: metallic glasses, relaxation, shear modulus, internal friction

1. Introduction

The non-crystallinity of glasses determines their gradual structural evolution, which is called structural relaxation. While the structural change itself is generally small, the corresponding property changes can be significant [1, 2] or even drastic [3]. One can separate structural relaxation well below the glass transition temperature T_g, which leads to the monotonic property relaxation [4], and structural relaxation close to T_g resulting in different signs of property changes [5], depending on preliminary heat treatment. These types of behavior are basically connected with the state of "metastable equilibrium" [5, 6]: while far below T_g this state is kinetically unachievable, near T_g it can

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