Shear Processes in Pd\textsubscript{40}Ni\textsubscript{40}P\textsubscript{20} Bulk Metallic Glasses D.J. SAFARIK, R.B. SCHWARZ, MST-8; Los Alamos National Laboratory — Depending on the imposed deformation rate, plastic deformation in metallic glasses can be either Newtonian or non-Newtonian. To investigate the influence of deformation history on non-Newtonian plastic flow in bulk Pd\textsubscript{40}Ni\textsubscript{40}P\textsubscript{20} glass we deformed the same volume of the glass specimen along differently oriented glide planes. We found that the glass has a memory of its previous plastic deformation, but this memory is largely independent of the previous glide direction. Loss of the memory follows first-order kinetics with a time constant of 1260 s at 553 K. The transition from Newtonian to non-Newtonian flow is rather abrupt and occurs at a Deborah number, \( De = \dot{\gamma} \cdot \tau = 0.5 \), where \( \dot{\gamma} \) is the plastic shear strain rate and \( \tau \) is the time constant for the exponential annihilation of the flow defects. This value of \( De \) is consistent with the value of \( De \approx 1 \) observed at the onset of flow instabilities in liquids. The abruptness of the transition, together with the strong stress-sensitivity of the viscosity in the non-Newtonian regime, suggests that the plasticity agents in the Newtonian and non-Newtonian flow regimes are not the same.