I8 - Tue 09:00-09:30 **Heat Treatment/Devitrification** Kleiner Saal / Small Hall

Structural rejuvenation with the change of local structure and mechanical properties in recovery annealed Zr-based metallic glasses

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Recently, structural rejuvenation, *i.e.*, recovery of the less relaxed state, in metallic glasses has been attracted attention from the viewpoints of improving mechanical properties as well as understanding a relaxation phenomenon originating from the intrinsic random atomic configuration. Relaxation state is generally regarded as one of the important parameters on various properties of metallic glass. Especially, since the good mechanical properties are usually lost by relaxation, we have to control it carefully for industrial use. The authors have investigated that the relaxation state is fixed by the cooling rate in the lower temperature region of the supercooled liquid state [1]. Based on the results, we have reported the recovery of less relaxed state (rejuvenation) of metallic glass through a simple thermal processing by annealing just above glass transition temperature followed by an appropriate cooling using the experimental [2] and simulation studies [3]. Here, it is found that the history of the relaxation is reset in the temperature around 1.1-1.2T_g, and the new relaxation state is introduced depending on the following (final) cooling rate by molecular dynamics (MD) simulation. Actually, the relaxation enthalpy can be got back (*that is*, the glassy alloy can be rejuvenated) for the almost fully relaxed glassy alloy by post annealing at 1.07T_g followed by the appropriate cooling at approximately 4 K/s in the $Zr_{55}Al_{10}Ni_5Cu_{30}$ metallic glass. In this presentation, we intend to evaluate the condition for rejuvenation in metallic glass and discuss on the change of local structure and mechanical properties by rejuvenation. The present study proposes a novel method on controlling relaxation state and provides useful information on the application of metallic glasses.

References:
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C22 - Tue 09:30-09:50 **Heat Treatment/Devitrification** Kleiner Saal / Small Hall

Tuning the memory dependence of vapour deposited metallic glasses

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Metallic glasses (MGs) show outstanding mechanical, physical and chemical properties and so provide a whole class of materials at the cutting-edge research in metallic and glassy systems [1]. By exposing them to thermal treatments, their properties get affected in a subtle and complex way. We present here a study of memory effects due to different thermal treatments in the atomic motion of rapidly quenched and vapour deposited CuZr MGs by means of x-ray photon correlation spectroscopy (XPCS). Vapour deposition is supposed to give rise to ultra-stable MGs, that is MGs with improved stability [2]. However information on their dynamics at the atomic level is still missing.
While cycling through a temperature protocol and measuring the dynamics of density fluctuations at different isothermal temperature steps, we find that vapour deposited MGs show a vanishing history dependence with rising annealing temperatures $T_a < T_g \lesssim T'_a$; although the absolute value of the relaxation time τ behaves inversely proportional with T_a. Moreover the dynamics in vapour deposited MGs is stationary while, in contrast, the fast quenched MG show the occurrence of aging during isotherm measurements.

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