Experimental evidence for a dynamical crossover in liquid aluminium — **Franz Demmel**, 1 and **Christoph Morkel** 2 — 1ISIS Facility, Rutherford Appleton Laboratory, Didcot, OX11 0QX, UK — 2Physikdepartment E21, TU München, 85748 Garching, Germany

The temperature dependence of the dynamic structure factor at next-neighbour distances has been investigated for liquid aluminium [1]. This correlation function is a sensitive parameter for changes in the local environment and its Fourier transform was measured in a coherent quasielastic neutron scattering experiment. The zero frequency amplitude decreases in a nonlinear way and indicates a change in dynamics around 1.4 Tmeltng. From that amplitude a generalized viscosity can be derived which is a measure of local stress correlations on next-neighbour distances. The derived generalized longitudinal viscosity shows a changing slope at the same temperature range. At this temperature the freezing out of degrees of freedom for structural relaxation upon cooling sets in which can be understood as a precursor towards the solid state. Thermodynamic calculations for the solid state predicted an upper temperature stability limit for the solid phase which corresponds favourably with our observations. That crossover in dynamic structural properties in the solid state is related to the experimentally observed change in the viscous behaviour. This is in agreement with the conception that the viscous slowdown is related to an extension of MRO through an aggregation of energetically-preferred atomic clusters.

**References**


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**Distinct dynamical regimes in a gold-based metallic glass revealed by X-ray photon correlation spectroscopy (XPCS)** — **Simon Hechler**, 1 Beatrice Rutik, 2 Zach Evenson, 3 Moritz Stolpe, 1, William Hembree, 1, Isabella Gallino, 4, and Ralf Busch 1 — 1Lehrstuhl für Metallische Werkstoffe, Universität des Saarlandes, Saarbrücken — 2Department of Chemistry and Biochemistry, Arizona State University, Tempe — 3Institut für Materialphysik im Weltraum, DLR, Köln — 4Heinz Maier-Leibnitz Zentrum, TU München, Garching

Although structural relaxation is a universal feature of glasses, the atomic-level processes involved still remain a puzzling mystery. XPCS has emerged as a novel technique for studying the microscopic dynamics of non-equilibrium condensed matter, as it enables the investigation of the structural relaxation time by resolving the translational atomic motion in non-equilibrium materials as metallic glasses. Using XPCS experiments, we follow the equilibration from the glass into the supercooled liquid of a gold-based metallic glass. The as-cast alloy shows different dynamical regimes as it approaches the glass transition. At low temperature, the relaxation time appears to be almost temperature independent. Upon heating, closer to the glass transition, the glass shows highly temperature dependent dynamics. In the supercooled liquid region, the material changes the equilibrium dynamics upon cooling to a significantly stronger dynamic behavior, without freezing to a glass. Such crossovers in the dynamics have not been observed in XPCS studies before and suggest the existence of complex structural relaxation mechanisms in this metallic glass forming material.

**References**