Configuration correlation governs slow dynamics of supercooled metallic liquids

With the support by the National Natural Science Foundation of China, the National Basic Research Program (973 Program) and Chinese Academy of Sciences, the research team led by Prof. Wang WeiHua (汪卫华) from the Institute of Physics, Chinese Academy of Sciences, cooperating with Prof. Guan PengFei (管鹏飞) from Beijing Computational Science Research Center, reported recently that configuration correlation is the key factor governing the slow dynamics of supercooled metallic liquids during the glass transition, which was published in *PNAS* (2018, 115(25): 6375—6380).

The structural origin of drastic slowing down of dynamics in metallic glass-forming liquids toward their glass transition temperatures is an important but unresolved issue. By performing advanced large-scale molecular dynamics simulations, the team reported that, contrary to the previous beliefs, it is not local structural orderings extracted from instantaneous configurations but the intrinsic correlation between configurations that captures the structural origin governing slow dynamics. More importantly, it is demonstrated by scaling analyses that it is the correlation length extracted from configuration correlation rather than dynamic correlation lengths that is the key to determine the drastic slowdown of supercooled metallic liquids. The growing dynamic heterogeneity, although intrinsically accompanying dramatic slowing down of the dynamics during glass transition, is not the primary origin but the consequence of slow structural relaxations in metallic glass-forming liquids. The key role of the configuration correlation sheds important light on the structural origin of the mysterious glass transition and provides an essential piece of the puzzle for the development of a universal theoretical understanding of glass transition in glasses.

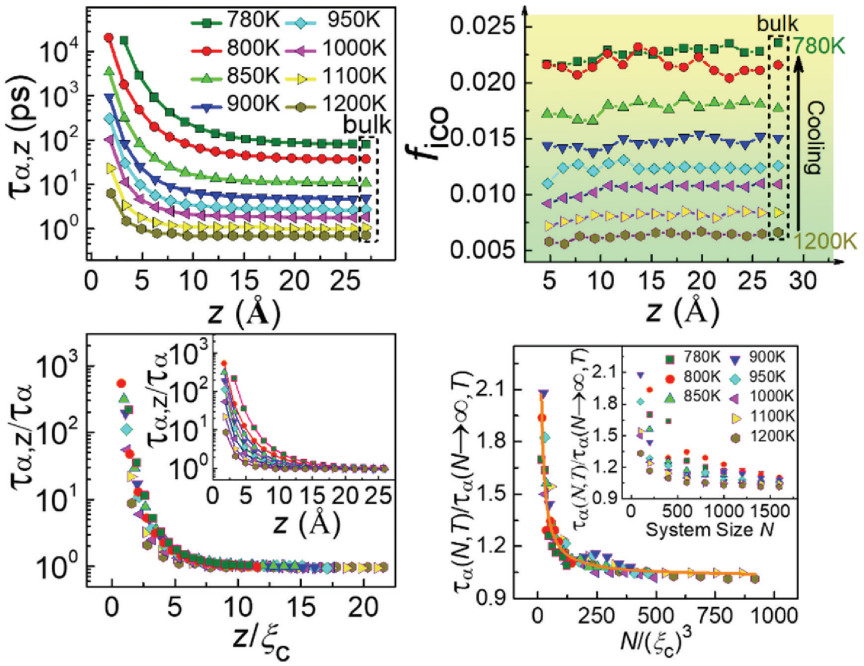

Figure The dynamics of the supercooled metallic liquids in 'sandwich' confinement slows down dramatically with increasing degree of confinement, but the fraction of local geometrical orderings like icosahedron does not change correspondingly. The slow dynamics is governed by the correlation length extracted from configuration correlation, whether the liquid is confined or not.