Structural and microscopic relaxations in a charged colloidal glass under aging

F.A.de Melo Marques[1], R. Angelini[2,3], E. Zaccarelli[3,4], B. Farago[5], B. Ruta[6], G. Ruocco[1,3], B. Ruzicka[2,3]

[1]Center for Life Nano Science, IIT@Sapienza, Istituto Italiano di Tecnologia, Viale Regina Elena 291, 00161 Roma, Italy; [2]IPCF-CNR, I-00185 Roma, Italy; [3]Dipartimento di Fisica, Sapienza Universita di Roma, I-00185, Italy; [4]ISC-CNR, I-00185 Roma, Italy; [5]Institute Laue-Langevin, BP 156, 38042 Grenoble, France; [6]European Synchrotron Radiation Facility, B.P. 220 F-38043 Grenoble, Cedex France. A**uthor's email: flavio.marques@iit.it**

The Q-dependence of the fast τ_1 and slow τ_2 relaxation times under aging of an anisotropic charged colloidal system, Laponite, has been studied. This complex system, characterized by a microscopic competition between attractive and repulsive interactions, ages spontaneously from an initial liquid state towards multiple arrested states such as gel and glass depending on clay and salt concentrations [1,2]. Here samples in salt free water conditions at weight concentration C_w = 3.0 wt% where the system forms a Wigner glass in few hours have been investigated. Through X-ray Photon Correlation Spectroscopy (XPCS) at the Troika beamline ID10 of ESRF, Neutron Spin Echo (NSE) at the spectrometer IN15 of ILL and a five angle Dynamic Light Scattering (DLS) a wide range of exchanged wavevectors Q and times has been explored. The microscopic relaxation time τ_1 does not change significantly with waiting time and it scales always as Q^{-2}, depicting the Brownian diffusive nature of particles motion. On the other hand, the structural relaxation time τ_2 shows two distinct behaviors: an initial exponential growth with waiting time associated to a Q^{-2} dependence again related to the Brownian diffusive dynamic, and a subsequent power law increase with waiting time characterized by a Q^{-1} dependence, depicting the discontinuous hopping diffusion of caged particles [3].

References

[1] - B. Ruzicka and E. Zaccarelli, Soft Matter **7**, 1268 (2011).

[2] - B. Ruzicka, E. Zaccarelli, L. Zulian, R. Angelini, M. Sztucki, A. Moussaid, T. Narayanan and F. Sciortino, Nature Materials **10**, 56 (2011)

[3] - F.A. de Melo Marques, R. Angelini, E. Zaccarelli, B. Farago, B. Ruta, G. Ruocco and B. Ruzicka. Structural and microscopic relaxations in a charged colloidal glass under aging. To be submitted.