Lineup of levitation techniques at SPring-8

Levitation and containerless methods allow enhanced glass formation due to the elimination of extrinsic heterogeneous nucleation. They also enable experiments on high-temperature liquids and deep undercooled liquids without contamination from containers. Recently, the use of levitation to study liquids and the formation of glasses from liquids has been considered particularly important in understanding the structure of non-glass-forming liquids and the process of glass formation.

We now provide three state-of-the-art levitation instruments, which are for aerodynamic levitation [1], electrostatic levitation [2], and acoustic levitation [3], at the SPring-8 beamlines. Aerodynamic levitation is the most popular levitation technique, because the instrument used for this technique is very compact and works well for a wide variety of materials. We can obtain reliable X-ray scattering data for very high temperature oxide melts, which can be reproduced by a reverse Monte Carlo modeling technique [Fig. 1(d)] [4].Electrostatic levitation allows us to perform not only X-ray scattering measurement but also *in situ* thermophysical property measurements.

Acoustic levitation has recently been optimized to levitate low-temperature liquids by using a cryojet [3]. This technique provides us with new potential applications of low-temperature liquids in pharmaceutical [5] and engineering sciences.

The three levitation instruments are usually used at beamline BL04B2. These instruments are planned to be used at other SPring-8 beamlines to enable the combination of different experimental techniques. Since levitation techniques enable us to achieve extremely nonequilibrium states, they can expand the potential application of undercooled liquids to not only fundamental sciences but also novel nonequilibrium material production from deep undercooled liquids.

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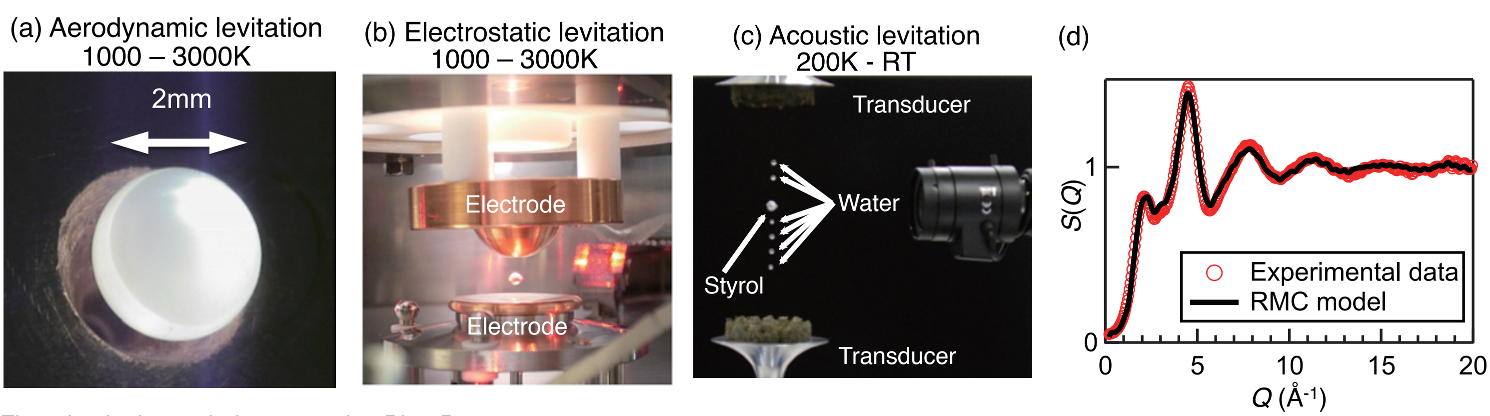

Fig. 1 Levitation techniques used at BL04B2:
(a) aerodynamic levitation, (b) electrostatic levitation, and (c) acoustic levitation. (d) Typical X-ray scattering data from levitated liquid Al_2O_3 measured at 2400 K with the results of RMC modeling [4]. In aerodynamic levitation, the sample is levitated by inert gas from a conical nozzle and heated by a CO_2 laser. In electrostatic levitation and acoustic levitation, the sample is levitated by either electrostatic force between two electrodes or sound fields generated by two acoustic transducers.

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