Physical Chemistry Chemical Physics 2016 vol.18 N38, pages 26444-26455

Metallic nanowires and mesoscopic networks on a free surface of superfluid helium and charge-shuttling across the liquid-gas interface

Moroshkin P., Batulin R., Leiderer P., Kono K.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016 the Owner Societies.We investigate the motion of electrically charged metallic nano- and microparticles produced by laser ablation in He gas and injected into superfluid helium. In the presence of a vertical static electric field, the particles either perform a repetitive shuttle-like motion transporting the charge across the liquid-gas interface or become trapped under the free surface of liquid He and coalesce into long filaments and complex two-dimensional mesoscopic networks. A classical electrohydrodynamic model is used to describe the motion of charged microparticles in superfluid He. The resulting filaments and networks are analyzed using electron microscopy. It is demonstrated that each filament is in fact composed of a large number of nanowires with a characteristic diameter of order of 10 nm and extremely large aspect ratios.

http://dx.doi.org/10.1039/c6cp04607j