Effects of High Magnetic Fields on Electrical Resistivity of Molten Pb and Sn

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High magnetic fieldsaffect the solidification structure and properties of materials by Lorentz force and thermo-electromagnetic force during metal solidification, the quantitative description of these two forces is related to the resistivity parameters under magnetic field [1-3]. In this study, a metal melt resistivity test platform under high magnetic field was independently developed. The four-electrode method was used to obtain the resistivity variation of Pb and Sn melts under 6 T magnetic field for the first time. The results show that when the magnetic induction intensity is constant, the resistivity of pure metal melt increases with the increase of temperature. When the external magnetic induction intensity is 2 T, the resistivity changes less than that of 0 T, When the magnetic induction intensity is 4 T, the resistivity increases significantly; under the condition of certain temperature, the resistivity of pure metal melt decreases first and then increases with the increase of magnetic induction intensity in the 0-6 T magnetic field, and the resistivity returns to the initial value after demagnetization. Meanwhile, after applying a magnetic field above 2 T, the resistivity basically increases linearly. Sn increases by about 46.1 % at 6 T near the melting point compared with 0 T, and Pb increases by about 29.1 % at 6 T near the melting point compared with 0 T.

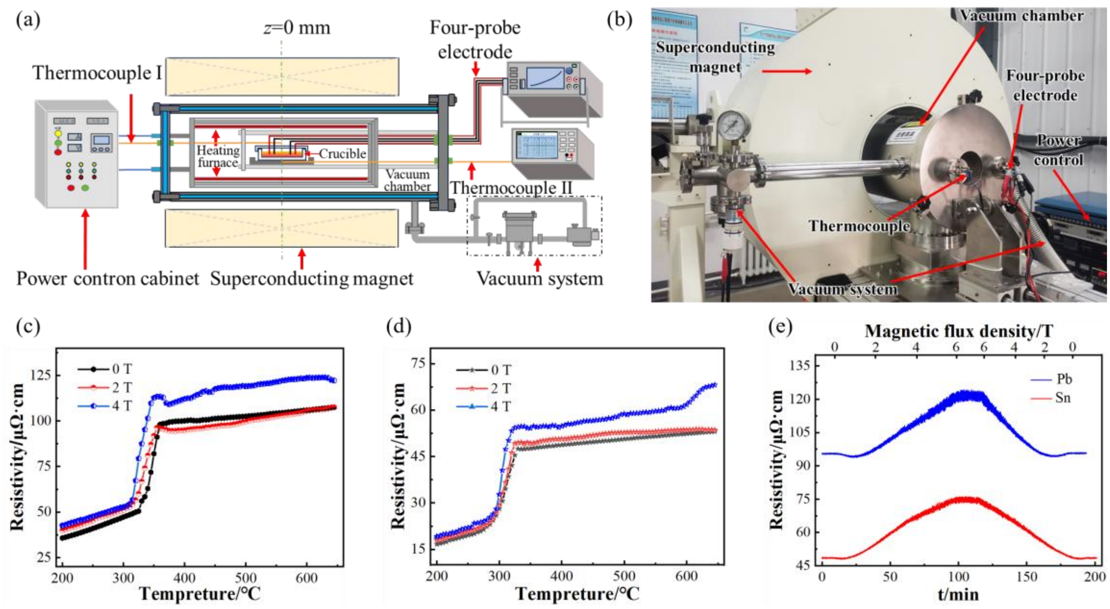

Fig. Resistivity test under high magnetic field: (a)diagram of test platform (a) test platform physical graph (b) Pb melt resistivity with temperature (c) Sn melt resistivity with temperature (d)Pb and Sn melt resistivity with magnetic field

[1] C. S. Lou, T. Liu, M. Dong, C. Wu, J. G. Shao, and Q. Wang, J. Magn. Magn. Mater. 424, 365–370(2017).

[2] S. Tu, Y. Mai, Y. Tong, T. Liu, M. Dong, and Q. Wang, J. Alloys Compd. 741, 1006–1011 (2018).

[3] S. L. Dong, T. Liu, M. Dong, X. Y. Guo, S. Yuan, and Q. Wang, Appl. Phys. Lett. 116, 053903 (2020).