Anomalous Effect of Surface Condition of Nano-Porous Glass on Superfluidity for Confined $^4$He

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Bose-Einstein condensate (BEC) in the three-dimensional network of nanometer-size pores has attracted the interest of researchers. We have performed ultrasound measurements for liquid $^4$He filled in a nanoporous glass (Gelsil), which was dried under different temperatures. We observed an enhancement of the suppression of superfluidity in the high pressure region, when the nano-porous glass was dried at high temperature. For the sample treated at high temperature, the amount of defect in the inert amorphous solid film increases by pressurization rapidly, compared with that at low temperature. The results demonstrate that the condition of amorphous solid $^4$He near the surface of the pore is changed by the heat treatment and affects the superfluidity of $^4$He.

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