The plastic flow of solid ^{4}He through a porous membrane

N. Mikhin, A. Lisunov, V. Maidanov, N. Neoneta, V. Rubanskyi, S. Rubets, E. Rudavskii, and V. Zhuchkov

B. Verkin Institute for Low Temperature Physics and Engineering of the National Academy of Sciences of Ukraine, Kharkov, Ukraine

The velocity of solid ^{4}He flowing through a porous membrane frozen into a crystal has been measured in the temperature interval 0.1 - 1.8 K using a flat capacitor consisting of a metalized plastic porous membrane and a bulk electrode. The clearance in the capacitor was filled with helium. The flow of helium through the membrane pores started as soon as d.c. voltage was applied to the capacitor plates. Above $T \sim 1$ K the velocity of the solid ^{4}He flow decreases with lowering temperature following the Arrhenius law. The activation energy of the process is close to that of vacancies. At low temperatures the velocity is only slightly dependent on temperature, which suggests a transition in ^{4}He from the classical thermally activated vacancy-related flow to the quantum plastic flow.

Section: QS - Quantum solids

Keywords: Quantum solids, Solid ^{4}He