

The Crystal Structure of Solid Helium-4 in Vycor

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In 2004, Kim and Chan found evidence that solid helium could exhibit superfluid like behavior, a phenomena dubbed supersolidity. Subsequent experiments have shown that the supersolid behavior is strongly modified by the quality of the helium crystals. In particular, crystals of very poor quality show the strongest supersolid effects. One way to create a very poor crystal is to grow it inside of a porous medium such as vycor glass, and, indeed, the first detection of supersolidity by Kim and Chan was inside vycor. However, the exact nature of solid helium in vycor is not known, even to the extent of the crystal symmetry. We present transmission x-ray diffraction experiments from solid helium in porous vycor glass in order to identify the structure of the crystal. At pressures up to 114 bar a single peak is observed in the diffraction pattern, which splits into three peaks above 114 bar. We tentatively identify the low pressure phase as BCC and the high pressure phase as HCP. Higher order peaks, could not, however, be observed, preventing definitive confirmation of these symmetries.