

Possible Effects of ^3He Impurities and Shearing on the Formation of Locally Amorphous Supersolid ^4He driven by a Pressure Gradient

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Possible anomalous states of ^4He crystal relevant to the possible onset of supersolidity in ^4He crystal were reported recently. Here, by treating the ^4He crystal locally as an amorphous matter and using the transition-state model¹ together with the specific activation volume as well as activation energy, we observe a series of sudden change of the shearing stresses (which directly relates to the local transport resistance) at corresponding onset temperatures of ^4He crystal for different activation volumes considering the role of ^3He concentration. We found that once the pressure forcing increases for fixed concentration of ^3He the transition temperature decreases which qualitatively agrees with previous results.

We also investigate the possible effects of different shear strain rates² as well as the pressure gradient upon the nearly frictionless transport of locally amorphous solid ^4He within a confined cylindrical domain for a fixed ^3He concentration. The tuning of different shear strain rates was found to play a crucial role in the formation of possible supersolidity in ^4He crystal. The only author is partially supported by the 2011-IMUST Starting Funds for Scientific Researcher.

¹K.-H. W. Chu, ChemPhysChem **11**, 3485 (2010). K.-H. W. Chu, Ann. Phys. (N.Y.) **323**, 2474 (2008).

²K.-H. W. Chu, J. Phys. Chem. B **112**, 3019 (2008).